ADVISORY TASK FORCE ON

ASBESTOS IN SCHOOLS

THE METROPOLITAN TORONTO
SCHOOL BOARD

MAY 1980

A D V I S O R Y T A S K F O R C E

O N

A S B E S T O S I N S C H O O L S

(A PRACTICAL DOCUMENT)

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INTRODUCTION

INTRODUCTION

A survey of all schools to determine the existence of any hazardous conditions due to asbestos was requested by the Ontario Ministry of Education in a memorandum to all Directors of Education July 17, 1979.

A second memorandum issued July 27 listed the major types of asbestos hazards that should be reported. A more detailed memorandum dealing with inspection, sampling and possible corrective action, plus a Ministry of Labour manual titled "Inspection of Buildings for Asbestos", was issued on January 25, 1980. Each of these memoranda is included in the report. (See Appendix A).

The Technical Committee of the Metropolitan Toronto School Board discussed the subject of asbestos in schools December 12, 1979. At a subsequent meeting February 26, 1980, an update of the possible locations of asbestos in Metropolitan Toronto schools was presented. It was recommended then that a special task force develop the expertise to advise and guide all area boards in Metropolitan Toronto on the most appropriate corrective action to be taken concerning

hazardous asbestos in schools.

On March 11, 1980 the Metropolitan Toronto School Board established an Advisory Task Force on Asbestos, with representation from each of the Area Boards, the Metropolitan Toronto School Board and Ministry of Education. The Task Force was charged with the responsibility of:

a) bringing together all available information on the subject necessary to take remedial action,
b) looking at the extent of the occurrence and use of asbestos, recommending necessary and appropriate corrective action, the priorities of such action and identification of the costs involved,
c) reviewing and recommending the proper equipment and material for the job,
d) reviewing the problem of disposing of the asbestos where removal is recommended,
e) reviewing the health hazard controls necessary in the removal of the asbestos and making appropriate recommendations and;
f) liaison with the Fire Marshal and Ministries of Education, Labour and Health as necessary.

The May 31, 1980 deadline for completion of a study and report did not allow time for original research.

The Task Force was conscious that recommendations should be easily understood, while there should be sufficient detail to authenticate the conclusions.

Too much technical detail tends to discourage all but the professionals most closely concerned. However, it was believed that it was necessary to keep some of the technical detail in the main text of the report because many of the most important recommendations are based on the technical and medical information received.

At the first meeting of the Task Force on March 18,1980 it was decided to divide the subject of asbestos in schools into a number of sections and assign members of the Task Force different sections to investigate.

Weekly meetings were held between March 18 and May 26, 1980 and the Task Force accumulated, assessed, interpreted and adapted a vast wealth of relevant information from both the United States and England. Frequently hours of reading of technical and medical

research publications was required to isolate the meaning in individual statements. It must be emphasized this report is considered to be a practical document rather than a technical or medical review.

Also because of time limitations, the Task Force did not consider it appropriate to open meetings to outside organizations or groups.

During its deliberations, the Task Force discovered that the subject of asbestos and its potential as a health hazard in the workplace has been studied over the past sixty years. Only during the past six to eight years has attention been given to the possibility that materials containing asbestos might also be creating a health hazard in the general environment. As a result, there has been insufficient information to arrive at rigid protective standards outside the workplace. Research is still under way.

The Task Force strongly encourages the Boards to adopt the guidelines outlined in this report.

Many of the basic concepts in this document were developed using the guidance documents Part 1 and Part 2,

(1978 and 1979), of the Environmental Protection Agency of the United States. Sincere appreciation is hereby acknowledged.

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SUMMARY OF RECOMMENDATIONS

SUMMARY OF RECOMMENDATIONS

The following is a summary of the recommendations that appear throughout the report according to the various subject related sections.

ASBESTOS

THE PROBLEM

Recommendation 1.

That, with the knowledge that friable asbestos-containing materials incorporated in buildings create a potential health hazard, it is essential that friable asbestos-containing materials be ultimately removed and where not possible, be isolated in all educational facilities.

Recommendation 2.

That all new schools and additions to schools constructed since 1975 be checked to determine if fire stop flaps are present and if found to be part of the construction be visually checked to determine if there is any opportunity for fibres to be released from the asbestos coating. If the edges of the paper are frayed, the flaps should be coated with a latex material approved by the Ontario Fire Marshal, prior to removal.

Recommendation 3.

That a single government agency be designated to be responsible for establishing and administering all aspects of environmental air quality control in buildings.

Recommendation 4.

That occupied rooms or areas be closed only if one or more of the following conditions exist:

a) there is visual suspected high asbestos dust contamination
b) severe exposure
c) material is damaged
d) material is subject to continuing contact
e) material is highly friable

LEGISLATION

Recommendation 5.

That the appropriate government agencies be requested to act immediately to develop comprehensive legislation dealing with the problem of asbestos in schools.

Recommendation 6.

That all existing requirements, regulations, legislation, codes and guidelines relating to asbestos be collected together in one publication issued by a single government agency.

Recommendation 7.

That the report of the Task Force be reviewed and updated as current and future knowledge on the subject of asbestos becomes available.

INSPECTION

Recommendation 8.

That all schools be visually and physically inspected for the presence of suspected asbestos-containing materials, regardless of the age of the building.

Recommendation 9.

That, where additions have been made to a school building, visual and physical inspections be made in each addition as well as in the original building.

Recommendation 10.

That only experienced Board technical staff or, if necessary, outside trained personnel be used to inspect

for possible asbestos-containing materials. The procedures for inspection as outlined should be carefully followed and the personnel involved should be advised of the exposure problem.

Recommendation 11.

That physical inspection be carried out only in accordance with the proper procedures and when the buildings are unoccupied.

Recommendation 12.

That when physical inspections are to be made, the air handling system be shut down.

Recommendation 13.

That records of the inspections made be retained for each building and updated. If positive evidence has been confirmed that no asbestos-containing material is present or has been definitely eliminated, inspection reports should so indicate the finding.

SAMPLING AND TESTING

Recommendation 14.

That no permanent corrective action be taken until the results of the analyses of bulk samples taken from the

suspect materials have been received.

Recommendation 15.

That bulk sampling be taken only by trained personnel who have been advised of the potential hazard involved in disturbing the material.

Recommendation 16.

That all personnel involved in the taking of bulk samples be equipped with proper protective clothing and equipment.

Recommendation 17.

That if there is any doubt regarding the presence of asbestos in taking only one sample, then several samples be used to ensure that a representative material content is obtained.

Recommendation 18.

That bulk samples be taken only when an area is unoccupied.

Recommendation 19.

That the procedures for taking bulk samples be carefully adhered to.

Recommendation 20.

That, as air sampling is not considered a valid means of determining the presence of asbestos materials within a particular building, it should not be substituted for a program of inspection, bulk sampling and analysis.

Recommendation 21.

That the proper government agency establish standards for laboratory accreditation and provide standardized test procedures to arrive at a common base for comparison.

Recommendation 22.

That only qualified laboratories that can provide the required analyses as outlined in the section entitled Sampling and Testing be used.

Recommendation 23.

That records of the analyses made be retained for each building and updated as any changes in the results are effected either by corrective action or by monitoring.

DATA EVALUATION

Recommendation 24.

That the priority scoring system be used by individual

boards as part of the process for determining the priorities within their own jurisdictions.

CORRECTIVE ACTION

Recommendation 25.

That wet removal be used as the method of eliminating friable asbestos-containing material unless exceptional conditions dictate otherwise.

Recommendation 26.

That the use of asbestos-containing materials in school facilities be discontinued where a substitute material exists.

Recommendation 27.

That encapsulation be used as a permanent corrective action only in specific areas difficult or impossible to treat in any other way.

Recommendation 28.

That at the present time only sealants approved by the Ontario Fire Marshal and meeting the latest Environmental Protection Agency (U.S.) test requirements be used for encapsulation and contractors be required to produce evidence of such approval prior to commencing work.

Recommendation 29.

That proper Canadian standards of performance and test requirements be developed for the approval of sealants.

Recommendation 30.

That ongoing monitoring procedures be established and maintained on a periodic basis where the "Retain & Isolate" option has been chosen.

Recommendation 31.

That in cases where either "Remove & Substitute" or "Retain & Isolate" options have been selected, only contractors familiar with the procedures and who are committed to the necessity of the stringent safety precautions be invited to tender.

Recommendation 32.

That where experienced contractors do not exist, attendance at an illustrated familiarization film lecture be mandatory for those wishing to tender.

Recommendation 33.

That suitable warning and safety signs be provided in the area of corrective action to advise persons entering the area about the hazards of exposure to asbestos.

Recommendation 34.

That inspection and control standards normally periodic in the building industry be upgraded to a daily or more frequently required scheduled inspection during any corrective action.

Recommendation 35.

That inspectors be required to attend familiarization lectures and have ready access to pertinent information.

Recommendation 36.

That inspection results be reported to the board, together with recommendations either to continue to monitor and repair, if necessary, or to "Remove & Substitute".

Recommendation 37.

That suitable warning and safety signs be affixed to any asbestos-containing material which has been retained in a building.

Recommendation 38.

That temporary precautions be instituted between the time of discovery of the suspected material and the time of any necessary corrective action.

Recommendation 39.

That the Ministry of Education be requested to provide funding in order to ensure a time-limited program aimed at the elimination of the absestos hazard potential in educational facilities.

DISPOSAL

Recommendation 40.

That all asbestos-containing material removed from a building be shipped in sealed containers and marked with warning labels.

Recommendation 41.

That the transportation of all asbestos-containing material for disposal be in accordance with the regulations of the Ministry of the Environment.

Recommendation 42.

That, in Metropolitan Toronto, the Metropolitan Toronto Works Department - Refuse Disposal Division be contacted for instructions on the disposal of asbestos-containing materials.

OPERATIONAL PRECAUTIONS

Recommendation 43.

That all personnel working with, or near, suspected or confirmed asbestos-containing materials be provided with proper instructions on the procedures to be taken for reducing the formation of dust to a minimum and be fully apprised of the potential exposure problem.

Recommendation 44.

That suitable warning and safety signs be provided in the area where maintenance is occurring on or near suspected or confirmed asbestos-containing materials.

Recommendation 45.

That procedures regarding the use of asbestos materials in teaching programs e.g. brake linings, clutch discs, be reviewed by the Technical Shop Directors.

3

TASK FORCE MEMBERS

TASK FORCE MEMBERS

CHAIRMAN

D. DUNLOP
Civil Engineer
Etobicoke Board of Education

MEMBERS

M. BELGRAVE
Civil Engineer
Metropolitan Toronto School Board

P. BISHOP
Structural Engineer
North York Board of Education

L. FERGUSON
Architect
Toronto Board of Education

J. GREEN
Civil Engineer
East York Board of Education

E. HIRST
Manager of Construction Services
York Board of Education

V. SHELTON
Mechanical Engineer
Scarborough Board of Education

S. ORLOWSKI
Architect (Ministry of Education Liaison)
Ontario Ministry of Education

G. DABBS
Chairman Technical Committee (Ex-Officio)
Metropolitan Toronto School Board

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ASBESTOS THE PROBLEM

ASBESTOS

THE PROBLEM

HISTORY

Asbestos, a name that embraces a number of fibrous mineral silicates, has been used in small amounts by man for thousands of years. In the aggregate it is a rock with all of a typical rock's rigidity, but broken up it yields fibres that can be spun as easily as cotton.

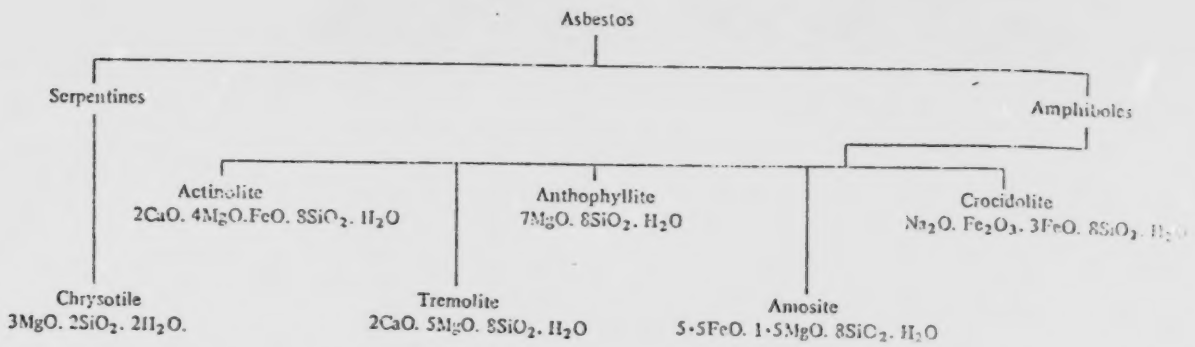
Asbestos remained primarily a curiosity until it was first mined commercially in the 1870's because of its flexibility, its tensile strength and its invulnerability to heat, acids and alkalies. Canada's first asbestos mine opened in Quebec in 1886. By 1947, Canada was mining and milling 66% of the world's asbestos. In 1977 it produced 33.6% of world production. Use of asbestos in the United States has grown 1000-fold in this century, compared to an 80-fold growth for petroleum. Canada, once the leading world producer of asbestos, currently ranks second to the U.S.S.R. Quebec accounts for 80% of the total Canadian production. British Columbia, The Yukon, Newfoundland and Ontario provide the remainder.

2. Amosite, a straight brittle fibre is light grey to pale brown in colour. It is mined in South Africa and is acid resistant.
3. Crocidolite, a straight fibre, blue in colour, is mined in South Africa, Western Australia and Bolivia. It is acid resistant and less flexible than chrysotile, but has greater tensile strength.
   This type produces the most severe asbestosis.
4. Anthrophylite, a brittle white fibre, is mined in Finland and U.S. and is acid resistant.

Other types of asbestos include tremolite (not used commercially) and actinolite. The varieties of asbestos and their chemical composition are shown on Page 22. The appearance of the more common asbestos fibres under the electron microscope are shown on Page 22.

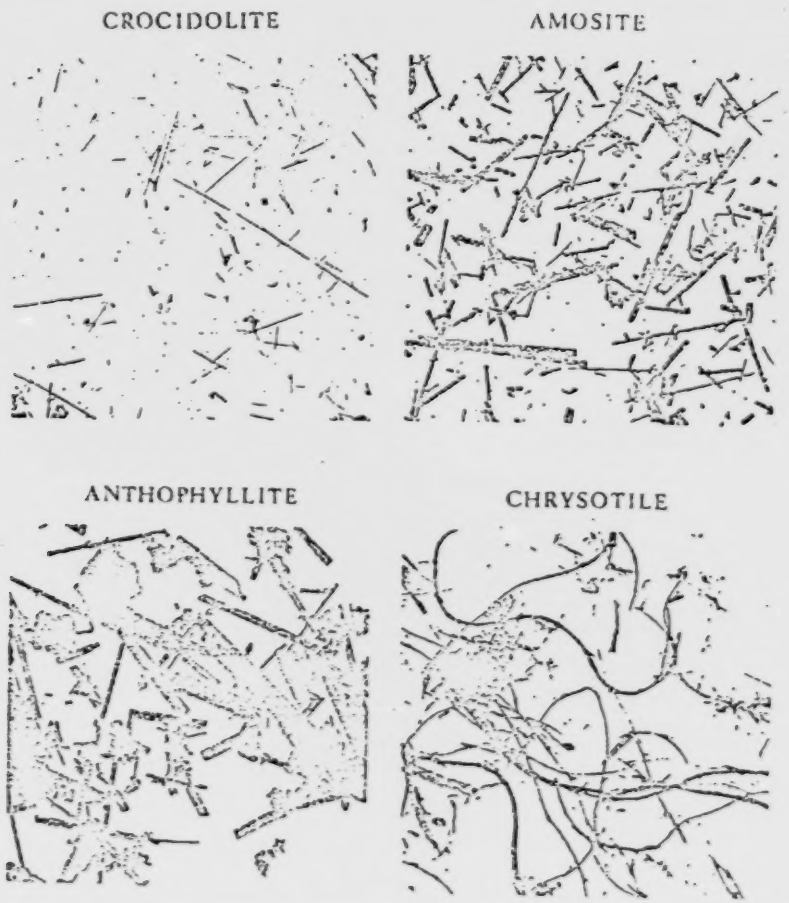
More than 90% of the chrysotile asbestos mined and milled in Canada is exported. Canada imports two other types, amosite and crocidolite asbestos. It has been estimated that, given existing reserves, the current rate of production in Canada can be sustained for nearly 50 years.

Varieties of asbestos and their chemical composition



Source: AA Hodgson, *Fibrous Silicates*, Royal Institute of Chemistry 1965

Appearance of asbestos fibres under the electron microscope (10μm) (Biol. effects p296) (Timbrell 1973)[1]



The most common asbestos minerals used in school building materials would be chrysotile (serpentine) and amosite (amphibole). Detection of the type of asbestos cannot be made by merely observing the colours since changes occur when the asbestos is mixed with other materials. Their natural colours also tend to change with age and the action of heat. Only bulk sampling and analysis will confirm the type of asbestos present.

Asbestos is widely used because it is a relatively cheap material, virtually indestructible, resistant to chemicals (particularly acids) and fire and it provides a high mechanical strength. It is also flexible and has good friction and wear characteristics. It readily lends itself to a variety of manufacturing processes because of its wet strength, its ease of formation into slurries (a soupy mixture) with water and its good drying characteristics. Since the beginning of the 20th century the use of asbestos has escalated to the point where it is used in approximately 3000 industrial applications. There has been a steep growth in its use since 1940.

Asbestos has numerous applications in homes, apartments, offices, schools, factories and hospitals. It is used as fire insulation, sound proofing, in floor tile, electrical insulation, fire-retardant clothing, lubricants and caulking materials, highway asphalt, acoustical tile and filters for fluids. It is also a component of steam turbines, gas turbines, rocket engines and space vehicles. (See Appendix B for a more complete list.) Asbestos is almost indispensable in all these applications. The widespread use of asbestos led to its uncontrolled distribution throughout much of the industrialized world and its appearance in the general environment.

ASBESTOS RELATED DISEASES

Originally asbestos health hazards were considered only in the occupational setting and it was generally recognized that prolonged and heavy inhalation of asbestos fibres could cause asbestosis, which is a chronic and debilitating lung disease. The first case of asbestosis (pulmonary firbrosis) was noted in England in 1900.

As more data became available and further research was completed, it became evident that the inhalation of asbestos fibres increases the risk of other diseases, such as lung cancer and mesothelioma, as well as cancer of the esophagus, stomach, colon and other organs. The first cases of lung cancer were reported in England in 1935. Mesothelioma was first reported as being caused by asbestos in 1954. The association of asbestos exposure and cancer of the gastro-intestinal tract was reported in 1974.

The indestructibility of asbestos fibres, their small size and fibrous shapes, make asbestos an unusual environmental contaminant. Asbestos fibres cannot easily be destroyed or degraded and the sizes and shapes of these fibres permit them to remain airborne for long periods of time. The normal cleansing mechanism of the lung would quickly remove more than 90% of any inhaled fibres, but those that are retained will remain indefinitely.

The time between the first exposure to asbestos and development of asbestos-related disease is generally 15 to 35 years. The length of latency period depends upon the level and duration of exposure.

APPLICATIONS OF ASBESTOS

The asbestos in solid materials does not create a health hazard. But whenever solid materials containing asbestos are ground, sawed or drilled or when asbestos that has been sprayed or trowelled dries and is damaged or disintegrates, potentially hazardous fibres are released into the air. The fibres are often no more than 1/25,000 of an inch long and can only be identified and counted under an electron microscope. At present, there is no confirming evidence to indicate what level of exposure to asbestos is risk-free. Consequently, all airborne concentrations of asbestos fibres should be considered significant.

a) Sprayed Asbestos

Of the many uses for asbestos, the technique of spraying onto structural surfaces is probably the most significant in causing asbestos exposure to both the workers during application and to the general population thereafter.

Sprayed asbestos may be subdivided into two broad categories, namely fibrous type and cementitious type.

The fibrous types are composed of asbestos and mineral fibres (i.e. fibreglass, rock wool). Different makers have their own individual binding agents. Special spray guns were used to combine the dry fibrous materials with water during application to either hard surfaces or open lath structures. This group of materials is soft and spongy, porous, lightweight and friable. A friable asbestos material is defined as any material containing more than 1% asbestos by weight that, when dry, can be crumbled, pulverized or reduced to powder by hand pressure. Sprayed-on thicknesses generally exceed 3/4 of an inch. In most instances, the material is shielded by suspended ceiling systems or may be exposed in non-public areas of schools, such as fan rooms and storage areas. To a lesser extent, the materials were sprayed onto ceilings and walls in auditoriums, gymnasiums, pool areas and shops for fireproofing, sound absorption or condensation control.

Many materials similar in appearance to sprayed asbestos do not necessarily contain asbestos. Some friable materials contain glass fibres, cellulose or other

mineral type fibres. However, where friable asbestos-containing materials have been used, they usually contain between 5% and 50% by weight asbestos.

In other instances, asbestos is usually mixed with a cementitious material, which is applied by machine on hard surfaces. This material is more dense, less friable and heavier than the fibrous types. Thicknesses are usually ½ inch or less. The major uses for cementitious materials have been for sound absorption or decoration and it is usually located in such areas as main lobbies, corridors, stairwells, music rooms, auditoriums and cafeterias.

Spray application of asbestos fireproofing and insulating material began in England in 1932. In 1950 more than half of the multistorey buildings constructed in the U.S. used some form of sprayed mineral fibre fireproofing. In 1972, after the health hazards of sprayed asbestos were recognized and documented, New York City Council banned spray application. In 1973 the U.S. Environmental Protection Agency (EPA) banned spray application of insulating or fireproofing material containing more than 1 per cent asbestos by weight. In 1978 EPA prohibited the application of sprayed asbestos for

nearly all purposes. Manufacturers of sprayed-on asbestos material in Canada, as responsible corporate citizens, also gradually eliminated the use of the material, even though no legislative ban was imposed in Canada.

b) Pipe Covering & Boiler Insulation

Friable asbestos material has been used for many years as a pipe covering and boiler insulation. In 1975 the EPA prohibited its use. Most Canadian manufacturers and applicators followed suit shortly thereafter. In the majority of cases, pipe covering and boiler insulation does not create a potential health hazard unless the friable insulation covering becomes broken and the asbestos is exposed.

Precautionary measures to be undertaken in completing corrective work are covered in section 11, Operational Precautions.

c) Ceiling Tiles

Not all ceiling tile will necessarily contain asbestos. If a major renovation project is to be done, a sample of the tile should be submitted

to an authorized laboratory (as outlined in recommendation 21, section 7, Sampling and Testing) for bulk analysis to determine if asbestos is contained in the material. Ceiling tiles are not considered to be friable and should not be of any concern. However, if the tiles are to be sawed, drilled or broken during renovations, maintenance work or demolition; proper precautions should be taken (as outlined in section 11, Operational Precautions).

d) Asbestos Covered Fire Stop Flaps

Since 1975 it has been mandatory to cover the fire stop flaps of fire-rated membrane ceilings with asbestos paper. This requirement was added to the National Building Code in the fire rating for the tested ceiling assemblies and is now in the Ontario Building Code.

FIBRE DISPERSAL

Fibres may be released from friable materials that are subject to deterioration or direct contact and damage. The release of fibres can also occur during construction or demolition and the material can lose its cohesive strength as it ages. The rate of fibre release is

usually at low-level but is continuous. The following summarizes the possibilities of asbestos fibre release in a school building:

1. Fallout from deteriorated material can occur without physical contact, simply as a result of air movement, variations of humidity or vibration of the structure.
2. Contact produces the highest rate of fibre release and can occur during school activities, maintenance or vandalism.
3. Resuspension in the air of fibres released earlier can occur during custodial action or school activities and can lead to high levels of contamination.

EXISTING STANDARDS

At present most standards covering the exposure to asbestos deal with occupational health concentrations. But there is even disagreement about what is an acceptable level of concentration in the workplace. The standards have varied from 12 fibres per cm^3 to the present level of 2 fibres per cm^3. These are fibres greater than 5 micrometres in length gathered over an

eight hour period on a time weighted average. Consideration is underway to lowering this figure to 0.1 fibres per cm^3. Where crocidolite asbestos is involved the present maximum approved concentration is 0.2 fibres per cm^3.

The standards allowed for a short-term sampling have varied from 10.0 fibres per cm^3 for a 15 minute sampling to the present value of 0.5 fibres per cm^3. The determination of the airborne concentrations of asbestos fibres in the workplace is done using phase contrast microscopy, which counts all the fibres in the air samples. Any particle having a length to width ratio greater than 3:1 and a length of 5 micrometres or greater is counted as a fibre. This technique does not measure the specific properties of a substance. Consequently all particles satisfying the 3:1 length width ratio are counted as asbestos fibres. In the workplace, where asbestos is handled, the premise that the total number of fibres counted are asbestos is considered a reasonable assumption.

But these tests are inadequate to determine if public exposure guidelines are being violated because the occupational health standards are less stringent than

the guidelines for the public. The tentative guideline (not a standard) that is applied in Ontario is 0.04 fibres per cm^3. A similar figuré has been arrived at through a study carried out by the British Occupational Hygiene Society (1968). It was considered that 0.4 fibres of chrysotile asbestos dust per cm^3 would create a negligible risk during a lifetime's working exposure and a divisor of 10 was applied to this level to give a maximum concentration of 0.04 fibres per cm^3 for negligible risk in a non-working situation.

It is interesting to note that in 1978 in Massachusetts a Special Legislative Commission on Asbestos developed its own guidelines for public exposure standards. Air samples were taken in nine schools that did not contain any asbestos and it was established that interprètation of air levels at or below 0.04 fibres per cm^3 was not possible due to normal background fibre levels. Their conclusion was that "airborne fibre concentrations in excess of this value are considered of significance." This lack of definitive standards for airborne asbestos in non-occupational environments and the expense of sampling and analysis as well as a lack of standard analytical procedures (if a true count of actual asbestos fibres is to be made) discourages airborne asbestos testing.

An exposed and friable surface, and the bulk analysis of the quantity of asbestos within the material, should be sufficient to provide the initiative to take action to reduce the potential health hazard as much as possible.

POTENTIAL RISK ASSESSMENT

The relative ease with which asbestos fibres may be released into a building is of primary concern. So, too, is the relative composition of the asbestos based material.

For the purpose of assessing the potential risk of fibre release, asbestos products used in buildings may be divided into the following categories, in descending order of risk:

a) Sprayed asbestos insulation;
b) Asbestos covered fire stop flaps, stage curtains, fire blankets;
c) Pipe covering and boiler insulation;
d) Ceiling tile;
e) Asbestos cement board, vinyl asbestos floor tiles, asbestos paints.

The highest source of asbestos exposure is fibre

release from friable sprayed asbestos insulation. Estimation of exposure risk from such material involves consideration of a number of factors and there is no simple solution for all situations. The primary solution is to reduce the exposure of asbestos to a minimum. There are six factors that may act singly or in combination to cause contamination and exposure of building occupants to asbestos fibres. These are:

a) Friability;
b) Condition;
c) Accessibility;
d) Air plenum or direct air exposure;
e) Activity and movement;
f) Percentage of asbestos.

All six factors are described and included in a mathematical formula developed under section 8, Data Evaluation.

It is acknowledged that these above noted factors may vary from room to room and from one area to another in the same room. Unique building structural characteristics or unusual material condition will influence the final assessment evaluation.

As each individual situation is appraised, a decision must be made on the corrective action to be taken. During the interval between discovery of an asbestos exposure problem and final resolution it may be possible to reduce exposure by control of maintenance, custodial and repair activities. Such temporary measures are described in section 9, Corrective Action.

All situations are not considered to require immediate action. It is the view that while all asbestos problems should be dealt with as quickly as possible, due regard should be given to the condition of the asbestos material and the availability of such resources as:

a) Space for the relocation of students;
b) Skilled workers;
c) Time; (It is better to leave a building alone temporarily than to create a greater exposure problem by doing an improper repair job in a hurry.)
d) Funding.

However, immediate corrective action should be undertaken after the discovery of an area where asbestos-containing material is deteriorating badly and highly accessible or where asbestos dust is evident.

Recommendation 1.

That, with the knowledge that friable asbestos-containing materials incorporated in buildings create a potential health hazard, it is essential that friable asbestos-containing materials be ultimately removed and where not possible, be isolated in all educational facilities.

Recommendation 2.

That all new schools and additions to schools constructed since 1975 be checked to determine if fire stop flaps are present and if found to be part of the construction be visually checked to determine if there is any opportunity for fibres to be released from the asbestos coating. If the edges of the paper are frayed, the flaps should be coated with a latex material approved by the Ontario Fire Marshal prior to removal.

Recommendation 3.

That a single government agency be designated to be responsible for establishing and administering all

aspects of environmental air quality control in buildings.

Recommendation 4.

That occupied rooms or areas be closed only if one or more of the following conditions exist:

a) there is visual suspected high asbestos dust contamination
b) severe exposure
c) material is damaged
d) material is subject to continuing contact
e) material is highly friable

5

LEGISLATION

LEGISLATION

GENERAL

Existing Federal, Provincial and Municipal legislation governing asbestos has been found to be extremely limited. However, legislative response to recent medical data and public awareness may be rapid. This will therefore require constant attention in order to maintain current knowledge of these developments.

The majority of legislation relates to the worker in the workplace and the environment and atmosphere that could be affected by the workplace.

Legislation governing facilities used by Boards of Education is the responsibility of Provincial authorities. The Ministry of Labour, Occupational Health Branch, and the Ministry of the Environment are the two Ministries of the Provincial Government that would establish asbestos-related guidelines under which Boards of Education in the Province of Ontario would have to abide.

The Ministry of Labour creates the jurisdiction under

the Occupational Health & Safety Act, which sets out standards by which school maintenance and construction personnel will undertake the task of working with asbestos.

The Ministry of the Environment sets standards for atmosphere quality outside of the building. They also rule on the method of transporting asbestos.

Local county and municipal governments should also be contacted to clarify the question of local by-laws and guidelines established to complement those established by Provincial and Federal jurisdiction. Typical local concerns that could be affected are: 1) Roads used to transport asbestos waste; 2) Dumping procedures; 3) Protection of sensitive areas.

This report has been written so that the user of the report should be abiding by Federal and Provincial legislation as well as local legislation applicable in Metropolitan Toronto (where such legislation already exists.)

Criteria and standards affecting all aspects of the

potential exposure to asbestos are now undergoing rapid change. As more tests and research is completed, there may be more stringent rules and regulations. Recently the Ontario Provincial Government has established a Royal Commission to study the problems of asbestos.

Letters, which are included in this section, were sent to two Ontario provincial ministries requesting information on the legislation that would have to be followed. Replies have been recieved from the Ontario Ministry of Labour and Ministry of the Environment and are included in this section.

Recommendation 5.

That the appropriate agencies be requested to act immediately to develop comprehensive legislation dealing with the problem of asbestos in schools.

Recommendation 6.

That all existing requirements, regulations, legislation, codes and guidelines relating to

asbestos be collected together in one publication issued by a single government agency.

Recommendation 7.

That the report of the Task Force be reviewed and updated as current and future knowledge on the subject of asbestos becomes available.

ADMINISTRATION OFFICES

THE BOARD OF EDUCATION BOROUGH OF EAST YORK 1967

340 COXWELL AVENUE
TORONTO, ONTARIO
M4C 2V3
465-4831

30 April 1980

Ministry of Environment,
150 Ferrand Drive,
DON MILLS, Ontario.

Attention: Mr. C. McFarlane

Dear Sir:

re: Leglislation of Asbestos

In recent conversation with your staff I have been able to glean information of existing Ontario Leglislation under Ministry of Environment jurisdiction as it applies to asbestos.

The school boards within the Metropolitan Toronto Schoool Board have formed a task force to review the occurrence and use of asbestos in the schools. Our recommendations regarding corrective action necessary to control the release of asbestos fibres will be a guideline paper used to assist not only Metropolitan Toronto Boards but numerous boards throughout Ontario.

An important integral of our guidelines will be the section relating to existing legislation by your Ministry and others as friable asbestos relates to both.

(1) Construction, maintenance and custodian workers working within our structures where friable asbestos is known to exist and contact is imminent.
(2) Students and staff living within a structure where friable asbestos is known to exist.
(3) The transporting of asbestos (in its various forms) from the school structure to a disposal site.

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ADMINISTRATION OFFICES

THE BOARD OF EDUCATION BOROUGH OF EAST YORK 1967

340 COXWELL AVENUE
TORONTO, ONTARIO
M4C 2V3
465-4631

(4) Procedures, methods and limitations of despositing and disposing of the asbestos at the disposal site.

We are equally concerned over the ability of sanitation landfill operators qualification to safely dispose of the material and would therefore appreciate information regarding sites qualified to deal with the asbestos related materials.

In order to maintain guidelines are complete we would appreciate a letter from your Ministry stating the precise legislation that we will be obligated to follow in the circumstances outlined above.

With a May 31, 1980 dateline of completion, we would appreciate your reply by May 21, 1980.

Please feel free to phone myself with respect to clarification or additional information regarding this request.

Yours truly,

J. A. Green, P. Eng.,
Manager of Plant.

ldh

ADMINISTRATION OFFICES

THE BOARD OF EDUCATION BOROUGH OF EAST YORK 1967

940 COXWELL AVENUE
TORONTO, ONTARIO
M4C 2V3
465-4631

25 April 1980

Occupational Health Branch,
Ministry of Labour,
400 University Avenue,
TORONTO, Ontario.
M7A 1T7

Attention: Mr. D.A. Brown

Dear Sir:

re: Legislation of Asbestos

In recent conversations with yourself and your staff I have been able to glean information of existing Ontario Legislation under Ministry of Labours jurisdiction as it applies to asbestos.

As we discussed the school boards within the Metropolitan Toronto School Board have formed a task force to review the occurrence and use of asbestos in the schools. Our recommendations regarding corrective action necessary to control the release of asbestos fibres will be a guideline paper used to assist not only Metropolitan Toronto Boards but numerous boards throughout Ontario.

An important integral of our guidelines will be the section relating to existing Legislation by your Ministry and others as friable asbestos relates to both.

(1) Construction, maintenance and custodian workers working within our structures where friable asbestos is known to exist and contact is imminent. (Maintenance, removal or encapsulation).
(2) Students and staff living within a structure where friable asbestos is known to exist.

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Yours truly,

J. Green, P. Eng.,
Manager of Plant.

ldh

Ontario
Ministry of
Labour

Occupational Health Branch
7th Flr., 400 University Ave.
Toronto, Ontario
(416) 965- 4066

May 5, 1980

Mr. J. Green, P. Eng.
Manager of Plant
The Board of Education Borough of East York
840 Coxwell Avenue
Toronto, Ontario
M4C 2V3

Dear Mr. Green:

This is in reference to your letter of April 25, 1980 regarding "Legislation of Asbestos". I have forwarded your letter to our Legal Branch who will provide you with information you have requested.

I trust this action will be satisfactory to you. If you have any further enquiries, please don't hesitate to contact us.

Yours very truly,

D. A. Brown

D. A. Brown, P. Eng.
Project Specialist
Special Projects Section

DAB:bki

Ontario

Ministry of the Environment

Central Region

Suite 700
150 Ferrand Drive
Don Mills, Ontario
M3C 3C3
(416) 424-3000

May 20, 1980.

Mr. J. Green, P. Eng.,
Manager of Plant,
East York Board of Education,
840 Coxwell Avenue,
Toronto, Ontario.
M4C 2V3

Dear Mr. Green:

Re: Asbestos

Your correspondence of April 30, 1980, requests comments with regard to four items on the control of asbestos. Items 1 and 2 deal with asbestos in the work place and may I suggest that you contact the Occupational Health Safety Division of the Ministry of Labour, who will provide guidance.

Items 3 and 4 deal with the disposal of asbestos waste. This matter is now under review by the Ministry and we will provide direction in this regard when guidelines are available.

In the interim period, please contact Mr. Trewin of our office if a specific disposal problem is encountered.

Yours very truly,

C.J. Macfarlane,
Regional Director.

GRT/bm
5-3

6

INSPECTION

INSPECTION

GENERAL

Most asbestos products are used in building construction and many of these products are found in school buildings. One of the first steps in any asbestos control program is to determine their location.

An Asbestos Program file system should be developed for each building in each board's jurisdiction. Included in the file should be two copies of floor plans for each building.

Building records can be checked for each building to ascertain if sprayed material containing asbestos was used for fireproofing, decorative or acoustical purposes. The Building Record Review Form (See attached form.) should be completed in duplicate. Should the review of the building records indicate that such materials were not used in certain buildings, this should be so noted on the form. Duplicate copies of the form should then be filed in the Asbestos Program file system for each building.

However, the checking of building records should

not take the place of visual and/or physical inspection.

The boards' experienced technical personnel or consulting firms (hereinafter referred to as personnel) can be assigned to examine all buildings and this inspection should be in strict accordance with the following procedures.

Visual Inspection

Visual inspection involves primarily a walk-through of the entire building by trained personnel. Particular attention should be paid to mechanical and storage rooms. The following procedures should be adhered to for this type of inspection. Personnel should:

a) Be properly instructed on this procedure and made aware of the exposure problem.
b) Be supplied with a copy of the floor plans, a copy of the Building Record Review Form and a copy of the Visual Inspection Form. (See attached forms.)
c) Complete a visual examination of every area in the building and record on the Visual Inspection Form all items suspected of containing asbestos. Specifically note the condition of suspect

sprayed materials used for ceiling or wall finishes and record these locations on the floor plans.

d) Finish the Visual Inspection Form and return with the floor plans to the Asbestos Program file system for each building.

Physical Inspection

Physical inspection involves checking those areas that are hidden from view and could require touching or disturbing asbestos-containing material. A more comprehensive procedure is required than for visual inspection. Personnel should:

a) Be properly instructed on this procedure and made aware of the exposure problem.

b) Be supplied with respirators approved by National Institute for Occupational Safety & Health, U.S.A. (NIOSH) for protection from asbestos dust, protective coveralls, head and neck protective covering and a High Efficiency Particulate Absolute (HEPA) vacuum cleaner.

c) Be provided with a copy of the completed Building Record Review Form, a copy of the completed Visual Inspection Form, a copy of the completed floor plans and a copy of the Physical Inspection Form. (See attached sample forms.)

d) Perform these inspections when the areas are unoccupied and after air handling systems have been shut down.

e) Carefully elevate and remove several suspended lay-in ceiling tile in each applicable area to ascertain if fire proofing material is installed in the ceiling space. Where sealed ceilings are encountered, access doors shall be opened to examine the ceiling spaces. Specifically note if the ceiling space containing suspect material is being used as a supply or return air plenum.

f) Remove ceiling mounted grilles in each area to ascertain if fire stops contain asbestos in their construction. Record the locations of same on the floor plans and the Physical Inspection Form.

g) Before departing an area where suspect material has been encountered, vacuum the protective coveralls, the shoes and the floor work space with an HEPA vacuum cleaner.

h) Finish the Physical Inspection Form and return with the floor plans to the Asbestos Program file system for each building. In each instance, suspected or confirmed asbestos material should be identified with a label applied on or

adjacent to the material. (See appendix E.)

i) Complete periodic inspections in areas where the following actions were taken:

   a) Exposed material has been isolated. (See section 9, Corrective Action.)

   b) Non-exposed material has been isolated. (See section 9, Corrective Action.)

   c) Applications have been judged to be stable. (See section 9, Corrective Action.)

In all instances, the personnel shall inspect for delamination, degradation or malicious damage. All inspections shall be recorded in the building Asbestos Program filing system.

Recommendation 8.

That all schools be visually and physically inspected for the presence of suspected asbestos-containing materials regardless of the age of the building.

Recommendation 9.

That, where additions have been made to a school building, visual and physical inspections should be made in each addition as well as in the original building.

Recommendation 10.

That only experienced board technical staff or, if necessary, outside trained personnel be used to inspect for possible asbestos-containing materials. The procedures for inspection as outlined should be carefully followed and the personnel involved should be advised of the exposure problem.

Recommendation 11.

That physical inspection be carried out only in accordance with the proper procedures and when the buildings are unoccupied.

Recommendation 12.

That when physical inspections are to be made, the air handling system should be shut down.

Recommendation 13.

That records of the inspections made be retained for each building and updated. If positive evidence has been confirmed that no asbestos-containing material is present or has been definitely eliminated, inspection reports should so indicate the finding.

(SCHOOL BOARD)

SCHOOL ASBESTOS PROGRAM

BUILDING RECORD REVIEW FORM

BUILDING _____

ADDRESS _____

BUILDING CONTACT PERSON _____ TELEPHONE _____

Completed by _____ Date _____

(SCHOOL BOARD)

SCHOOL ASBESTOS PROGRAM

VISUAL INSPECTION FORM

BUILDING_____

ADDRESS_____

BUILDING CONTACT PERSON_____TELEPHONE_____

Completed by_____Date_____

(SCHOOL BOARD)

SCHOOL ASBESTOS PROGRAM

PHYSICAL INSPECTION FORM

BUILDING _____

ADDRESS _____

BUILDING CONTACT PERSON _____ TELEPHONE _____

Completed by _____ Date _____

7

SAMPLING AND TESTING

SAMPLING AND TESTING

GENERAL

Once an inspection program has been conducted to ascertain whether a problem may exist, it remains then to be confirmed what materials are present.

Any decision to take corrective action will depend on the results of an analysis of (bulk) samples taken from the suspect materials. A recommended procedure for taking these samples is contained in this section.

Air sampling is not a valid means of determining the presence of asbestos materials within a particular building. It relates only to the local airborne fibre concentration at the particular time the sample is taken.

A complete sampling and testing record should be kept with unique identification numbers used to correlate all data relating to individual samples. This record should be retained in the Asbestos Program file system for each building, as indicated in section 6, Inspection.

BULK SAMPLING

Bulk samples are the only positive way of identifying the presence and content of asbestos in a given material. Improper sampling procedures will result in unreliable analysis and may lead to either unnecessary corrective action, or to untreated, potentially hazardous situations.

The following items are recommended for any sampling program:

1. Personnel should be trained people who have been made aware of the potential hazard involved in disturbing the material.
2. All personnel taking part in the sampling process should be equipped with proper protective clothing and equipment:
   a) Respirator, NIOSH approved for asbestos;
   b) Coveralls, either disposable or kept separate for cleaning purposes;
   c) Head and neck covering;
   d) High Efficiency Particulate Absolute (HEPA) vacuum cleaner.
3. Sampling containers should be sealable, airtight, and capable of being decontaminated externally after the sample has been collected (i.e. plastic

or glass). Containers should be labelled accurately, identifying school, location within the building, date taken, and unique sample identification number. The label should also indicate the presence of a possible hazard, (i.e. Asbestos Inspection Program).

4. It has been found that in some instances, a single sample may give an erroneous indication of the actual content of the material. If there is any doubt about the presence of asbestos, several samples should be taken to assure that a representative material content is achieved.

A recommended procedure for sampling is as follows:

1. Take samples when the area is unoccupied.
2. Only properly equipped persons engaged in the sampling process should be present.
3. Place plastic sheeting below the area to be sampled to catch any falling material.
4. Disturb the material as little as possible. Spray the area around where the sample is to be taken with a light mist of water to prevent dusting.
5. Collect a reasonable amount of the sample (about one teaspoonful) in an appropriate container. Tightly close the sample container and wipe the exterior of the container with a damp cloth to decontaminate it. Label the container identifying

the school, location within the building, date, sample identification number, and Asbestos Inspection Program.

Samples of "hard" materials such as cementitious plaster or ceiling tile can be taken by breaking away a small portion and placing this in the sample container.

6. If pieces of material break off during sampling, vacuum and/or wet mop areas where they have fallen.
7. Decontamination of the area and sampling personnel must be completed before moving on or reopening the area to use.
8. Send the sample to an analytical laboratory.

For sample identification and record, a typical Asbestos Sample Report Form is attached.

AIR SAMPLING

Air sampling, as mentioned previously, cannot be used to determine the presence of asbestos materials in a building, and should not be substituted for a program of inspection, bulk sampling and analysis.

It is not, however, without merit. The best scientific opinions reflect the belief that airborne fibre concentrations in schools will not approach those

experienced in the industrial workplace. Yet the remote possibility exists that a severe individual circumstance may be revealed. In this case, immediate action would be warranted. Air sampling also may demonstrate to those uncertain of the potential hazard, that the level of airborne fibre concentration in the school environment is only a fraction of the present or even proposed standard relating to continuous exposure in the workplace. Standards relating to acceptable levels of airborne fibre concentrations in ambient air are now being reviewed by government agencies.

Air sampling is performed with a pump, which draws a volume of air through a membrane filter at a predetermined rate. Common sampling rates are 2.0 litres per minute for personnel monitoring (occupational hazard) and 10 litres per minute for general environmental sampling. Sampling times are in the order of 30 to 480 minutes, depending on the anticipated fibre concentrations. The membrane filter may be stored indefinitely in its container but care must be taken in transporting samples to avoid loss of fibres from the filter surface by mechanical agitation.

Air sampling can be a useful tool during a removal or containment operation and is a requirement of the

proposed specifications listed elsewhere in this report. Samples taken after the work is completed give a means for checking the quality of the air. so that building occupants can reasonably assume that the hazard has been controlled. Analysis of the samples obtained during this operation must be done by a qualified laboratory, since minute levels are to be expected.

TESTING (Analysis)

The sample analysis, both bulk and air, must be done by a competent technician using appropriate techniques. Improper analysis could result in incorrect assessment of the magnitude of the problem.

Bulk sample analysis should be done by either; Polarized Light Microscopy (PLM) or X-Ray Diffraction (XRD).

PLM is a technique used to identify asbestos fibres by their shape and unique optical properties. It is a relatively inexpensive ($35.00 - $40.00) and quick method for identifying asbestos in bulk samples. PLM is particularly suitable for examination of the complex mixes of friable construction materials.

XRD is recommended where a second independent analytical technique is necessary to confirm an analysis by PLM. It is a more expensive ($75.00 - $80.00) analytical method.

Electron Microscopy is not a recommended analytical technique for bulk sample asbestos analysis. It is costly ($450.00 - $500.00 per sample), time consuming and limited in availability.

Phase Contrast Microscopy is a technique used to count fibres present in air samples. It is unacceptable for identification of asbestos in bulk samples.

Analysis of air samples is done by Phase Contrast Microscopy or Electron Microscopy.

Phase Contrast Microscopy is an economical ($35.00 - $50.00) optical technique for viewing small particles rather than a method for measuring specific properties of a substance. It is a technique based entirely on the shape of each particle observed, rather than a method for measuring specific properties of a substance. It is not inherently specific for identifying asbestos fibres although a skilled technician can make an

"educated estimate" of the asbestos fibre content. This technique is particularly useful where asbestos material is known to exist and only the relative concentration of airborne fibres is in question.

Electron Microscopy permits detailed examination and identification of asbestos fibres of all sizes. Asbestos fibres in their smallest dimensions are identifiable by this method. Each fibre is counted and its length and width measured. Total fibre numbers can then be estimated. This analysis is time consuming, and coupled with the initial equipment investment and the necessity of highly skilled personnel, it becomes an extremely expensive ($450.00 - $500.00 per sample) testing technique.

A comparison of asbestos analysis techniques available is shown in the attached table at the end of this section.

LABORATORY REPORTING

It is important that a complete written and signed record of all samples and their analysis be kept.

Each sample should have its own unique identification

number and all reports should relate to that number. The laboratory should report the following information for each sample submitted:

1. Sample identification number.
2. Analytical method used to analyse the sample. The report should name the analytical equipment and the technique used to perform the analysis.
3. A description of the sample appearance and consistency.
4. An account of what was done to the sample prior to analysis.
   (Asbestos materials were not always uniformly mixed before application. Some materials present in the sample may not be detected if the sample is not homogenized).
5. Analyst should report the types and percentages of each type of asbestos present. The estimated precision associated with the percentage of asbestos reported for each sample should be specified.
6. Analyst should report what non-asbestos fibrous materials are present in the sample and the percentage present, and provide the basis for that judgment. Identification of other fibres present will minimize the reporting of false results.

7. Comments on any other materials present.
8. Description of quality control procedures followed during the analysis.

Recommendation 14.

That no permanent corrective action be taken until the results of the analyses of bulk samples taken from the suspect materials have been received.

Recommendation 15.

That bulk sampling be taken only by trained personnel who have been advised of the potential hazard involved in disturbing the material.

Recommendation 16.

That all personnel involved in the taking of bulk samples be equipped with proper protective clothing and equipment.

Recommendation 17.

That if there is any doubt regarding the presence of

asbestos in taking only one sample, then several samples should be used to ensure that a representative material content is obtained.

Recommendation 18.

That bulk samples be taken only when an area is unoccupied.

Recommendation 19.

That the procedures for taking bulk samples be carefully adhered to.

Recommendation 20.

That, as air sampling is not considered a valid means of determining the presence of asbestos materials within a particular building, it should not be substituted for a program of inspection, bulk sampling and analysis.

Recommendation 21.

That the proper government agency establish standards for laboratory accreditation and provide standardized test procedures to arrive at a common base for comparison.

Recommendation 22.

That only qualified laboratories that can provide the required analyses as outlined in the section entitled Sampling and Testing be used.

Recommendation 23.

That records of the analyses made be retained for each building and updated as any changes in the results are effected either by corrective action or by monitoring.

ASBESTOS SAMPLE REPORT FORM SAMPLE IDENTIFICATION # ____

Building Name: _____

Address: _____

Contact Person at Building: _____ Telephone: _____

SAMPLING RECORD Time: _____ Date: _____

Type of Sample: Bulk ☐ Air ☐

Location: _____

Method of Sampling: _____

_____

Name of Person Taking Sample: _____ Signature: _____

Supervisor's Siganture: _____

TESTING RECORD Date: _____

Name of Testing Facility: _____

Type of Test Required: Bulk: Polarized Light ☐ X-Ray Diffraction ☐
Air: Phase Contrast ☐ Electron Microscope ☐

Description of Sample: _____

_____

Method of Testing: _____

_____

Percentage of Asbestos: _____

_____

Other Material Present: _____

_____

Comments: _____

_____

_____

_____

Name of Testing Technician: _____ Signature: _____

Name of Person to Receive Results: _____

Address: _____

A COMPARISON OF ASBESTOS ANALYSIS TECHNIQUES AVAILABLE

Method	Advantages	Disadvantages
1. Bulk Sample Analysis		
a. Petrographic microscopy	Relatively rapid and low cost per analysis, suited for exact identification of mineral(s) present and estimate of abundance.	High level of operator training and experience required.
b. X-ray diffraction	Unambiguous mineral fiber identification, rapid "fingerprinting" of sample with permanent record.	High investment in training personnel and capital equipment. May not detect minor fiber abundances especially if other crystalline phases are present.
c. Electron microscopy	"Absolute" determination of fibers present, and identification of mineral species.	High equipment and analysis costs. Highly trained operator required.
2. Ambient Air Sample Analysis		
a. Phase contrast microscopy	Low cost per analysis, low cost for equipment, extensive training not required, presently the most detailed standard procedure available.	Limited resolution, fibers less than 5 μm not counted, therefore, hazardous situations may be missed altogether.
b. Electron microscopy	Closest to obtaining "absolute" fiber count because of high resolution and identification ability.	In addition to disadvantages in 1.(c) above, procedural standards not available, poor precision and accuracy.

8

DATA EVALUATION

DATA EVALUATION

GENERAL

This section deals with the evaluation of data collected during the processes of inspection, bulk sampling and analyses of bulk samples.

The objective of data evaluation is to indicate the urgency of any particular situation relative to others.

It is not meant to be a basis for determining the type of control or corrective action to be taken as it is felt that other considerations will, in many cases, determine the type of action needed.

It must also be recognized that the data being evaluated relate only to that obtained from inspection, bulk sampling and analysis of bulk samples. There may be many other important factors that are pertinent to the decision-making process and may override the indications gained from the data evaluation outlined in this section.

In perspective, it should be recognized that the subject of the hazards of exposure to asbestos is one

that the scientific community is now endeavouring to delineate more definitely. There is no uncertainty regarding the causal link between high-level exposure and disease. However, there is a lack of knowledge about the quantitative relationship between lower levels of exposure (such as may be encountered in school environments) and the incidence of all adverse responses in those who are exposed. Indeed it is questionable whether such a relationship does exist. Therefore, the attitude of society -- which may complicate an already complex situation -- may well be the determining factor when assessing the urgency and priority of action. The decision will be a social decision, not a scientific one, and will be based on the influential opinion prevailing at the time. In this context, the data evaluation process outlined in this section will itself be subject to evaluation.

SCOPE

As with the entire report, the inspection process is meant to provide guidance for action with respect to all forms of asbestos. Some type of precautionary action will be necessary wherever asbestos is identified, whether from a knowledge of the material used or from confirmation by bulk sample analysis.

Some measures will be urgent and immediate, while others may be undertaken later, ultimately at demolition -- meaning the entire building or a portion for alterations, replacements or renovations.

The Task Force considered that a scoring or rating system may provide a useful tool in the assessment of priorities for control or remedial action. It was felt there was no need to apply such a system where there was visible evidence of dislodged material, as "fall-out" from erosion, abrasion, degradation or failure of adhesion. In such instances, immediate attention is needed without any further evaluation except that the percentage of asbestos present would indicate a measure of priority.

The scoring or rating system would therefore, be applicable to conditions intermediate between those where it was considered appropriate to "Accept Stable Situations" (See section 9, Corrective Action.) and those where immediate action was considered necessary. It is meant to relate primarily to sprayed-on systems.

Consideration was given to the "Ferris Index" system devised for use in Massachusetts public schools as well as to an outline of an "Exposure Number" system under review by EPA. The system proposed in this

report is similar in many respects to each of these two systems, but differs in the method of computation.

The system is an imprecise one, based on subjective assessments in most instances and is meant to be a tool rather than an authoritative determination. Moreover, it has not been subject to any field testing and on this account, its present usefulness is limited to individual board applications and would not permit comparison of priorities among boards.

FACTORS

Measurements of dust concentration or airborne fibre levels would provide the most direct means for assessing exposure.

Air sampling techniques and sample analyses have yet to be developed to the stage where they can be accepted as reliable indicators of urgency. Nor have minimum levels of "accepted" exposure been set. Eventually these techniques and analyses may be sufficient to determine degrees of urgency. In fact, existing techniques may be used as preliminary indicators. But now the only sure indicator of urgency is considered to be visual evidence of fibre release or fall-out.

Consideration must be given to factors that have a bearing on the potential release of fibres. The following six factors were selected and each was assigned a relative weighting:

Friability	100
Condition	100
Accessibility	50
Air Plenums/Direct Air Exposure	50
Activity & Movement	25
% Asbestos	25

Each factor should be considered (preferably on a group basis rather than on an individual basis) and the evaluation group should assign one of the following numerical values.

Level of Concern	Numerical Value
Nil	0
low	1
medium	2
high	3

The proper numerical value for each factor is then multiplied by the factor's particular weighting to arrive at a factor rating. These six factor ratings are summed to give the location rating. Each location selected for evaluation should have definable physical limits within which the factors being considered are

at a reasonably uniform level. For example, an auditorium with an inaccessible ceiling space in the stage area would be evaluated separately from a very accessible space in the audience area.

FACTORS AND LEVELS - DEFINITION

a) Friability - This term applies to dry material that can be crumbled, pulverized or reduced to powder by hand pressure. The material must be touched in order to evaluate the friability and friability itself must be considered as distinct from physical condition resulting from age, deterioration, damage or lack of cohesiveness. (These factors are considered under Condition.)

Levels of concern

Level '0' - The material is non-friable and firmly bound in a matrix.

Level '1' - The material is slightly friable. It is difficult yet possible for it to be crushed to powder by hand. This may apply to most cases of well-applied trowelled material.

Level '2' - It is not difficult to remove surface material from underlying asbestos by hand and to crush to powder e.g. inferior trowel application, moderately good spray-on application.

Level '3' - The material is soft, fluffy or spongy and surface material breaks away, with little pressure, from underlying asbestos material.

b) Condition - This factor involves an assessment of the quality of installation, adhesion of the friable material to the underlying surface, material deterioration, and damage (whether by contact, abrasion, water, erosion, vandalism, missiles or the like, incidental or accidental). The material may be delaminating or it may have been dislodged. Some materials tend to deteriorate rapidly in humid environments and are susceptible to fragmentation from water leaks.

Levels of concern

Level '0' - Material condition is excellent, even though it may be highly friable.

Level '1' - There are signs of mild damage in small area(s).

Level '2' - There are signs of moderate damage. Material is beginning to delaminate or come loose from the substrate.

Level '3' - Severe damage or deterioration is evident. Areas are missing, though there is no visible evidence at the time of the actual debris itself. The material has little cohesiveness.

c) Accessibility - This is a measure of susceptibility to damage by accidental or intentional contact by persons. The ease with which the material cán be reached and the frequency of this likely occurrence are elements of this factor. With ceilings, for example, a 10 ft. height is a reasonable limit for direct contact under normal circumstances, but in areas like gymnasiums, cafeterias, hallways and stairwells, the behaviour of the student population may increase the likelihood of contact irrespective of ceiling heights.

The proximity of the material to building service installations requiring maintenance or periodic repairs or adjustments is another element of this factor.

The evaluation of accessibility does not take into account the danger that released fibres, from whatever cause, will result in contamination of the air breathed by persons within the building under normal building usage. The factor "Air Plenums/Direct Air Exposure" deals with this concept.

Levels of concern

Level '0' - Material is completely enclosed and not accessible without breaking the enclosure membrane or barrier, completely isolated and sealed off from rest of building. (Not meant to be evaluated as part of the scoring or rating system.)

Level '1' - Material is inaccessible and beyond the reach of building occupants except during infrequent maintenance and repair in its immediate vicinity.

Level '2' - Material is accessible to building occupants in quiet activity areas and/or for regular custodial and maintenance activities in its immediate vicinity to location.

Level '3' - There is a high likelihood of physical contact due to frequent routine maintenance and/or to activity of building occupants.

d) Air Plenum/Direct Air Exposure - This factor is a measure of how likely asbestos material will contaminate air within a supply or return air

plenum or within a space that is not completely sealed from the surface of the material. It covers instances where a direct air stream flows on to the material, whether within a plenum or not, as well as instances where the material is visible from within any space and not separated from the air in that space. Areas with louvres, grids or other openings are considered to be "exposed".

Levels of concern

Level '0' - The material is not in an air plenum and is completely separated from air in the space to which the evaluation is being applied. There is no likelihood of this separation being disturbed except in unusual circumstances such as alterations or renovations or unexpected damage from external factors.

Level '1' - Exposure, "by air", is possible in infrequent cases where access panels are removed; otherwise there is no exposure. There is no air conveyance in plenums.

Level '2' - Exposure, "by air", occurs as in Level '1', together with exposure by way of louvres, grids or other open ceiling systems. There is no air conveyance in plenums.

Level '3' - Exposure occurs by way of air plenum or more than 10% of surface as exposed and visible at all times.

e) Activity and Movement - This is a measure of the likelihood that air will be contaminated as a result of building vibration from machinery or another source or from activity levels of the building occupants. (It does not relate to air movement, which is covered by the previous factor, nor to physical contact with the material, which is assessed under Accessibility).

Levels of concern

Level '0' - Activity and movement is negligible, insofar as it may be considered a potential cause of fibre release. Asbestos material is located in quiet low activity areas such as administrative areas, libraries or infrequently used areas, none of

which is subject to any noticeable vibration from external factors (e.g. traffic) or internal factors (e.g. machinery, movement in adjacent or contiguous areas.)

Level '1' - These areas are similar to those outlined in Level '0' above, but some vibration may be noticed due to external or internal factors on an occasional basis.

Level '2' - These are areas where vibration can be expected on a regular basis due to occupant activity, machinery or other source.

Level '3' - These rooms contain machinery that give rise to high levels of vibration of more or less continuous duration. These areas may also be affected by heavily travelled highways, subways, railways, airways, or by high levels of occupant activity (e.g. gymnasiums, cafeterias, some hallways, stairwells.)

f) Percentage of Asbestos - The higher the percentage of asbestos, the higher the potential for asbestos

fibre release and for ambient air levels of asbestos. The actual percentage is established by analyses of bulk samples. Where this is expressed as a percentage range, rather than as a single percentage, the upper level of the range will be used for the calculations of the factor rate. (See section on Sampling for guidance on sample procedures necessary to obtain representative sample of valid significance.)

Levels of concern

Level '0' - Trace amounts less than 1%.

Level '1' - 1% to 20%.

Level '2' - More than 20%, up to 50%.

Level '3' - More than 50%.

SUMMARY

The scoring system proposed here helps set priorities among locations without taking into consideration the measured area of any location. A small area with a high location rating may have a smaller potential for contamination than a large area with small location rating. Thus the system's usefulness as a tool has to be supplemented by the evaluation

group's assessments and judgment of such situations.

Also, the system does not indicate any factors relating to costs (first costs, life-cycle costs), budgetary provisions or to the availability of other resources. The extent to which these factors will have a bearing on the program development will vary. The availability of space, or funds or procurement procedures, may well determine that a location with a lower score is corrected before a location with a higher score. The scoring system is, after all, nothing more than a tool to assist in the decision-making process. As a tool, it needs to be tested and its acceptability proven before it can be relied upon. Above all, its acceptance and validity must depend on the application and maintenance of uniform standards of judgment across all the locations evaluated and across time. This is best achieved by a dedicated team effort, with the group comprised of at least 2 persons well versed in their undertaking and fully aware and convinced of its value.

Recommendation 24.

That the priority scoring system be used by individual boards as part of the process for determining the priorities within their own jurisdictions.

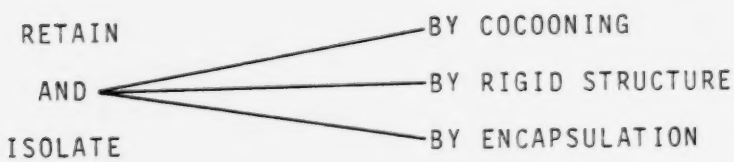
9

CORRECTIVE ACTION

CORRECTIVE ACTION

GENERAL

The weight of evidence in the industrial workplace is undeniable -- long exposure to significant quantities of asbestos fibres does cause damage to our bodies. Levels of exposure to asbestos in schools will likely be extremely low by comparison. Nevertheless, when the presence of asbestos materials is confirmed by sampling and testing, it is incumbent upon the boards to neutralize these potential hazards by instituting an orderly, thoughtful remedial program. Such a program would be based upon three concepts:



Establishing the appropriate option or options can be time consuming. So during this period of assessment, a fourth option of Temporary Precautionary Measures can be instituted. The following is a description of typical conditions to be found in each category.

OPTION 1

REMOVE & SUBSTITUTE - CATEGORIES

Short Term Control

Under this heading any friable material subject to deterioration should be considered. The work should be given a high priority and should not be held up while arrangements are made to establish funding. Possible areas for short term remedial action are:

a) Exposed friable sprayed asbestos that is subject to damage by accident or vandalism in occupied areas, e.g. - music rooms, gymnasiums, pools.

b) Non-exposed friable sprayed asbestos that is subject to attrition by air flow and/or vibration (traffic, planes, subway), e.g. ceiling plenums, fan rooms as plenums, air ducts.

c) Frayed asbestos sheet or paper in air delivery systems. Fire flaps - duct wrapping, fire curtains and fire blankets.

d) Exposed friable sprayed asbestos that is subject to damage by accident in service areas, e.g. mechanical rooms, boiler rooms, storage rooms, crawl spaces.

Specifications for the removal of friable asbestos are to be found in Appendix C. Possible asbestos-free substitutes are shown in Appendix D.

Long Term Control

Under this heading are included stable materials subject to damage through normal usage. Corrective work would be absorbed into the normal maintenance routine and funding, rather than undertaken immediately. It would be removed and replaced as required. Examples of such materials would be transite table tops, welding screens, pipe coverings, boiler insulation, etc.

REMOVE & SUBSTITUTE - METHODS

Removal

Sprayed asbestos can be removed while it is WET OR DRY. But DRY removal has been shown to cause additional hazards by contaminating previously asbestos-free sections of a building. So this method is not

considered to be a recommended option.

WET removal, on the other hand, renders the material much less friable, more cohesive. There is less chance that dust will spread to asbestos-free areas of the building atmosphere. The process is difficult, demanding and expensive, when done properly and in accordance with the specifications. (See Appendix C.) It is however, the final solution.

Substitution

Great care should be taken to ensure that the materials substituted have characteristics suitable for the particular application (fire proofing, acoustical, thermal insulation). Only use materials that have passed the testing procedures of the Underwriters Laboratory of Canada and have also received the recent approval of the Ontario Fire Marshal. Use traditional materials wherever possible. A list of possible asbestos-free substitutes is shown in Appendix D.

OPTION 2

RETAIN AND ISOLATE - CATEGORIES

Encapsulation, Cocooning, Rigid Structures

The work under this heading should be scheduled as soon as possible and should not be held up while arrangements are made to establish funding.

An example of a condition where this solution could be considered is where friable sprayed asbestos, exposed or non-exposed, is subject to attrition and damage in non-student areas, e.g. ceiling spaces, mechanical rooms, storage rooms, etc.

RETAIN AND ISOLATE - METHODS

General

'Retention and isolation of friable asbestos is viable only where the space to be isolated contains no mechanical or electrical services requiring regular maintenance. The offending material will have to be removed eventually; so the lifetime cost, including attendant monitoring should be compared to removal and substitution before selecting this delaying action.

Encapsulation

Much has been said of encapsulation; the direct spraying of friable asbestos material with either a penetrating chemical or bridging liquid to seal in asbestos fibres. The adhesive quality of a sprayed asbestos material was designed to support its own weight. The encapsulation process adds to the original weight and naturally puts an added strain on the adhesive quality. Therefore, failure is possible, either at the time of application or later. None of

the materials being proposed for encapsulation was originally designed for spraying over asbestos. As a result, their capabilities vary widely. The most significant variable, however, is the standard of the original installation and its present condition.

These unknown factors set against the costs involved, make encapsulation a very doubtful procedure. Hence, it should be used only in specific areas difficult or impossible to treat in any other way.

However, if encapsulation is considered, the sprayed asbestos must be in good condition and the encapsulation sealant material must receive the approval of the Ontario Fire Marshal. (See memorandum Appendix A.) It should also meet the testing requirements of the EPA until such time as Canadian standards have been developed.

Cocooning

Cocooning would envolve loosely wrapping the friable sprayed-on material with a wire mesh that would be tackwelded or otherwise secured to the structure -- though not the sprayed member. The mesh would then be sprayed with a flexible, lightweight, plastic bridging chemical, with characteristics acceptable

to the Ontario Fire Marshal. The acceptability of the materials will depend on whether the location is within an air plenum or not.

Rigid Structure (Enclosure)

Enclosure of asbestos materials is possible with rigid structures such as plaster on metal lath, drywall on metal studding, suspended drywall ceiling or 4" block skinwall suitably sealed at the perimeters. These methods can add considerable weight to a structure and their application may be limited for this reason. Structural engineering advice should be obtained.

Isolation installations must always be identified with a warning sticker and should never enclose services likely to require ongoing maintenance. The use of traditional trades and materials make this solution deserving of consideration in some circumstances. (See section 11, Operational Precautions.)

Ongoing monitoring of the physical integrity of the isolated areas of asbestos is an essential component of this option. These costs, plus subsequent repairs and eventual controlled removal, are all lifetime cost considerations.

OPTION 3

ACCEPT STABLE APPLICATIONS

General

Where asbestos is already isolated by an uninterrupted membrane or is within a stable matrix, no remedial action is considered necessary unless demolition or renovation is being considered. Periodic visual inspections are, however, required.

Some examples of the material in question are vinyl asbestos floor tile, cement asbestos siding, sewer pipes, building siding, wall lining, fumehoods, mounting boards, sprayed asbestos enclosed by drywall under stairs or dead ceiling areas, sprayed cementitious material and trowelled cement asbestos, e.g. wall and ceiling decoration.

OPTION 4

TEMPORARY PRECAUTIONARY MEASURES

General

It will naturally take time to inspect, sample and test, evaluate data, prepare tender documents, obtain and approve costs. During this period it is possible to take common-sense action, at little expense, to reduce the level of concern and limit potential hazards. Here are just a few of many possible actions:

a) Discourage use of ball-throwing games in gyms, pools etc.

b) If suspected friable asbestos is susceptible to misuse or is in a damaged condition with fallout, vacate and seal off an individual room or rooms.

c) Do not recirculate air from suspected asbestos-containing air plenums. Provide complete exhaust and substitute with 100% fresh air. (This is more acceptable during the temperate months.)

d) Call meetings, if deemed necessary, to explain the board's position to parents, students, teachers and non-teaching staff.

e) Do wet cleaning in the suspected areas.

f) Delay any maintenance or renovation work planned for the area unless it is absolutely necessary.

g) Revise the work procedure on any necessary repairs to the asbestos-containing materials, e.g. wet spray prior to repair of pipe insulation. (See section 11, Operational Precautions.)

h) Remove any hard asbestos-containing materials requiring repair from the site and wear approved respirators when cutting or drilling the material.

COSTS

Costs will vary with the size and complexity of the situation and may of necessity involve all manner of

associated expenses peculiar to a specific job. These expenses may include busing, temporary accommodation, overtime, damage to carpets and finishes, removal and reinstallation of furniture and lighting fixtures (dated lighting fixtures may be renewed) and testing for asbestos. In addition, there is no performance data available in Ontario for the removal or isolation of asbestos. Both of these operations are encumbered by stringent safety procedures (See Specifications Appendix C) and generally costs of projects to date do not reflect these difficulties. Nevertheless, from the limited information available from the United States, Western Canada and Ontario, the following range of costs might be experienced -- plus, of course, the associated expenses referred to here, which may be considerable in themselves.

	Per Sq. Ft. Surface Area Measured Flat
Removal & Substitutions, including protection and clean up	$1.25 - $17.00 Plus special costs
Retention & Isolation	The cost of Retention and Isolation of friable asbestos only differs from Removal & Substitution in that the scraping and disposal actions are not included at the time when this corrective option is exercised.

It is estimated that the total cost of the remedial work to correct the asbestos problem in the public schools of Metropolitan Toronto might be in the region of $4,000,000. However, additional work must be done before definitive costs can be properly assessed.

Recommendation 25.

That wet removal be used as the method of eliminating friable asbestos-containing material unless exceptional conditions dictate otherwise.

Recommendation 26.

That the use of asbestos-containing materials in school facilities be discontinued where a substitute material exists.

Recommendation 27.

That encapsulation be used as a permanent corrective action only in specific areas difficult or impossible to treat in any other way.

Recommendation 28.

That at the present time only sealants approved by the Ontario Fire Marshal and meeting the latest Environmental Protection Agency (U.S.) test requirements be used for encapsulation and contractors be required to produce evidence of such approval prior to commencing work.

Recommendation 29.

That proper Canadian standards of performance and test requirements be developed for the approval of sealants.

Recommendation 30.

That ongoing monitoring procedures be established and maintained on a periodic basis where the "Retain & Isolate" option has been chosen.

Recommendation 31.

That in cases where either "Remove & Substitute" or "Retain & Isolate" options have been selected, only contractors familiar with the procedures and who are committed to the necessity of the stringent safety precautions be invited to tender.

Recommendation 32.

That where experienced contractors do not exist, attendance at an illustrated familiarization film lecture be mandatory for those wishing to tender.

Recommendation 33.

That suitable warning and safety signs be provided in the area of corrective action to advise persons entering the area of the hazards of exposure to asbestos.

Recommendation 34.

That inspection and control standards normally periodic in the building industry be upgraded to a daily or more frequently required scheduled inspection during any corrective action.

Recommendation 35.

That inspectors be required to attend familiarization lectures and have ready access to pertinent information.

Recommendation 36.

That inspection results be reported to the board, together with recommendations either to continue to monitor and repair, if necessary, or to "Remove & Substitute".

Recommendation 37.

That suitable warning and safety signs be affixed to any asbestos-containing material which has been retained in a building.

Recommendation 38.

That temporary precautions be instituted between the time of discovery of the suspected material and the time of any necessary corrective action.

Recommendation 39.

That the Ministry of Education be requested to provide funding in order to ensure a time-limited program aimed at the elimination of the asbestos hazard potential in educational facilities.

10

DISPOSAL

DISPOSAL

TRANSPORTING

Asbestos-containing materials have to be transported carefully, so as not to emit fibres to the atmosphere. The contaminated material at the work site should be sealed (if not, an air tight container vehicle must be made available), marked with a warning label (See Appendix E.) and placed on the transporting vehicle in such a way that a puncture or tear will not occur in the material containers. The transporting vehicle shall be of a style that will not permit loss of load or asbestos emission into the atmosphere.

Prior to commencing transportation, the transporter must apply for a "hazardous waste management certificate" from the Ministry of Environment. When making application the transporter will be required to outline his procedure and amend it where instructed by the Ministry.

DISPOSAL AT DUMP SITE

The owner of the dump site/landfill operation is responsible to the applicable jurisdiction to operate his site in an approved manner. It is the responsibility

of the transporter to identify the contents of his load to the landfill operator.

Within the Metropolitan Toronto Region, the contractor and/or transporter must identify himself to the Metropolitan Toronto Works Department - Refuse Disposal Division for disposal approval under the following guidelines before commencing work.

DISPOSAL WITHIN METROPOLITAN TORONTO

a) Contractors disposing of asbestos-related materials within Metropolitan Toronto shall contact the Metropolitan Toronto Works Department - Refuse Disposal Division for disposal approval.
b) The contractor will be informed by the Refuse Disposal Division where and how to dispose of the various forms of materials. Proof of such direction should be provided to the board before permission is granted to commence the removal work.
c) The contractor will be held liable if he varies from the prescribed procedure and practice.

The above guidelines could prove to be a practical procedure for all contractors/transporters in other

cities, counties or townships in order to ensure immediate disposal, rather than storage of the asbestos contaminate.

During research for disposal of asbestos-containing materials, it became apparent that there is a lack of firm information regarding the availability of proper dump sites and regarding legislation on protective measures at dump sites.

Letters, which are included in this section, were sent to the Ministry of Environment and the Metropolitan Toronto Works - Refuse Disposal Division requesting information on relevant legislation. Replies have been received from the above agencies and are included in this section.

Recommendation 40.

That all asbestos-containing material removed from a building be shipped in sealed containers and marked with warning labels.

Recommendation 41.

That the transportation of all asbestos-containing material for disposal be in accordance with the regulations of the Ministry of Environment.

Recommendation 42.

That, in Metropolitan Toronto, the Metropolitan Toronto Works Department - Refuse Disposal Division be contacted for instructions on the disposal of asbestos-containing materials.

ADMINISTRATION OFFICES

THE BOARD OF EDUCATION BOROUGH OF EAST YORK 1967

840 COXWELL AVENUE
TORONTO, ONTARIO
M4C 2V3
465-4831

30 April 1980

Ministry of Environment,
150 Ferrand Drive,
DON MILLS, Ontario.

Attention: Mr. C. McFarlane

Dear Sir:

re: Leglislation of Asbestos

In recent conversation with your staff I have been able to glean information of existing Ontario Leglislation under Ministry of Environment jurisdiction as it applies to asbestos.

The school boards within the Metropolitan Toronto Schoool Board have formed a task force to review the occurrence and use of asbestos in the schools. Our recommendations regarding corrective action necessary to control the release of asbestos fibres will be a guideline paper used to assist not only Metropolitan Toronto Boards but numerous boards throughout Ontario.

An important integral of our guidelines will be the section relating to existing legislation by your Ministry and others as friable asbestos relates to both.

(1) Construction, maintenance and custodian workers working within our structures where friable asbestos is known to exist and contact is imminent.
(2) Students and staff living within a structure where friable asbestos is known to exist.
(3) The transporting of asbestos (in its various forms) from the school structure to a disposal site.

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940 COXWELL AVENUE
TORONTO, ONTARIO
M4C 2V3
465-4631

(4) Procedures, methods and limitations of despositing and disposing of the asbestos at the disposal site.

We are equally concerned over the ability of sanitation landfill operators qualification to safely dispose of the material and would therefore appreciate information regarding sites qualified to deal with the asbestos related materials.

In order to maintain guidelines are complete we would appreciate a letter from your Ministry stating the precise legislation that we will be obligated to follow in the circumstances outlined above.

With a May 31, 1980 dateline of completion, we would appreciate your reply by May 21, 1980.

Please feel free to phone myself with respect to clarification or additional information regarding this request.

Yours truly,

J. A. Green, P. Eng.,
Manager of Plant.

ldh

ADMINISTRATION OFFICES

THE BOARD OF EDUCATION BOROUGH OF EAST YORK 1967

840 COXWELL AVENUE
TORONTO, ONTARIO
M4C 2V3
466-4631

1 May 1980

Metro Refuse,
439 University Avenue,
Phoenix House,
TORONTO, Ontario.
M5G 1Y8

Attention: Mr. G. Kelly

Dear Sir:

re: Asbestos Disposal

In recent conversations with yourself we discussed the guidelines applicable to disposing of asbestos at landfill operations within your jurisdiction.

The school boards within the Metropolitan Toronto School Board have formed a task force to review the occurrence and use of asbestos in the schools. Our recommendations regarding corrective action necessary to control the release of asbestos fibres will be a guideline paper used to assist not only Metropolitan Toronto Boards but numerous boards throughout Ontario.

An important integral of our guidelines will be the section relating to existing legislation and approvals as it relates to asbestos.

The following guidelines to contractors are as we discussed as they will appear in our paper:

(1) Contractors disposing of asbestos related materials within Metropolitan Toronto shall submit for disposal approval from the Metropolitan Toronto Department of Refuse.

...../2

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THE BOARD OF EDUCATION BOROUGH OF EAST YORK 1967

840 COXWELL AVENUE
TORONTO, ONTARIO
M4C 2V3
466-4631

Metro Refuse

(2) The contractor will be directed (and show proof of direction to owner) by Metro Department of Refuse as to where and how to dispose of the various forms of asbestos requiring disposal.

(3) The contractor shall be held liable by the authority having jurisdiction where he varies from the procedure and practice as directed by Metropolitan Toronto Department of Refuse.

In order to maintain guidelines are complete, we would appreciate a letter from your department concurring with or stating an ammended version of the above procedure and practice.

With a May 31, 1980 dateline of completion we would appreciate your reply by May 21, 1980.

Please feel free to phone myself with respect to clarification or additional information regarding this request.

Yours truly,

J. Green, P. Eng.,
Manager of Plant.

JG/ldh

The Municipality of
Metropolitan Toronto

Metropolitan Works Department
10th Floor, Phoenix House
439 University Avenue
Toronto, Ontario M5G 1Y8
Telephone (416) 367-8286

F.J. Horgan, P.Eng. A.A.E.E.
Commissioner of Works

Address all correspondence
to the Commissioner
Attention of **Mr. G.A. Kelly**
367-8286

May 14, 1980

The Board of Education
Borough of East York
840 Coxwell Avenue
Toronto, Ontario
M4C 2V3

Attention: Mr. J. Green, P.Eng.
Manager of Plant

DISPOSAL OF HAZARDOUS MATERIAL
- ASBESTOS
OUR FILE NO. 1600.27

Further to your letter of May 1st, respecting the disposal of asbestos, please be advised that we have forwarded a copy of your letter to the Ministry of the Environment, asking their approval for the disposal of this material at our landfill sites, and we will await their reply re any conditions which they may apply to same.

We have no objections to the guidelines outlined in your letter, and would further add that should there be no problem with the Ministry of the Environment, we would insist that all contractors be required to put the asbestos in 6 mil plastic bags. Delivery to our landfill sites would be at designated hours, for placement in designated spots, which may vary from time to time and should be confirmed shortly before the proposed date of disposal.

I. McKerracher, P.Eng.
Director - Refuse Disposal Division

GAK:bs 12127

Ontario

Ministry of the Environment

Central Region

Suite 700
150 Ferrand Drive
Don Mills, Ontario
M3C 3C3
(416) 424-3000

May 20, 1980.

Mr. J. Green, P. Eng.,
Manager of Plant,
East York Board of Education,
840 Coxwell Avenue,
Toronto, Ontario.
M4C 2V3

Dear Mr. Green:

Re: Asbestos

Your correspondence of April 30, 1980, requests comments with regard to four items on the control of asbestos. Items 1 and 2 deal with asbestos in the work place and may I suggest that you contact the Occupational Health Safety Division of the Ministry of Labour, who will provide guidance.

Items 3 and 4 deal with the disposal of asbestos waste. This matter is now under review by the Ministry and we will provide direction in this regard when guidelines are available.

In the interim period, please contact Mr. Trewin of our office if a specific disposal problem is encountered.

Yours very truly,

C.J. Macfarlane,
Regional Director.

GRT/bm
5-3

11

OPERATIONAL PRECAUTIONS

OPERATIONAL PRECAUTIONS

GENERAL

Efforts should be made to remove entirely, or safely treat, all forms of asbestos materials in the school environment. However, as has been indicated previously in the report, there will be times when complete removal or treatment of all asbestos materials in schools cannot be accomplished immediately. It is conceivable that all materials containing asbestos will not or cannot be eliminated from use.

This section covers the operational precautions to be taken by custodial, maintenance, service and repair personnel (whether on board staff or in the employ of contractors retained by the board) building users and occupants when working with or being near to materials suspected of containing asbestos. It is separated into the following headings:

DEFINITIONS
OPERATIONAL PRECAUTIONS - CUSTODIAL PERSONNEL
OPERATIONAL PRECAUTIONS - MAINTENANCE & CONTRACTING PERSONNEL
OPERATIONAL PRECAUTIONS - BUILDING USERS & OCCUPANTS

It also provides guidelines to be followed when

working with or near the varied categories of materials, suspected or confirmed to contain asbestos, that might remain in the school after corrective action has been completed.

DEFINITIONS

For clarification purposes. and in order to assist in the correct use of this section, the following definitions are provided.

Custodial Personnel - These are persons employed in the daily, regular operation of a building. They may provide among other things, cleaning services, monitoring, or adjusting of mechanical and electrical equipment such as fans, pumps and lighting. Security officers and building operation supervisors would be included.

Maintenance Personnel - These are employees of the building owner involved in major or minor repairs or adjustments to the building fabric and equipment. These include, but are not necessarily limited to, carpenters, plumbers, pipe fitters, electricians, refrigeration technicians, controls technicians, and all their foreman and supervisors.

Contracting Personnel - These are persons, contractors or firms hired for a specific project or duty, and paid on a contractual basis.

Building Occupants and Users - These are persons occupying the building on a daily basis such as teachers, students and clerical staff. Also included are persons visiting the building to conduct business or attend meetings, night classes or lectures on an occasional basis.

Approved - "Approved" refers to the regulations of the U.S. Department of Labour - Occupational Safety and Health Administration (OSHA) and the recommendations of the U.S. Department of Health, Education and Welfare - National Institute for Occupational Safety and Health (NIOSH).

OPERATIONAL PRECAUTIONS - CUSTODIAL PERSONNEL

A. When Working Near to Materials Suspected of or Containing Friable Asbestos

1. If the material is in an undamaged and well contained condition (no sign of deterioration) and if it is not intended to disturb it in any way:

a) No special precautions are required.

b) Exercise care while working to prevent any disturbance of the material.

c) Advise the principal of the presence of the material if this had not been done previously. The Principal will arrange to have a warning sticker installed on or near to the material. (See Appendix E.)
Do not touch or disturb the material in any way. If it has already been identified and labelled, no notification is required.

2. Where there is evidence of damage or deterioration to the material, such as chunks flaking off and falling, or hanging loosely from structural members such as beams, joists, roof deck, or where there is unusual build-up of material in the form of dust on floor, desks, shelves and other surfaces:

a) Immediately install an appropriate warning sign in a conspicuous location at the entrance to the area. (See Appendix E.)

b) Close off the area and immediately advise the Principal of the condition discovered and the action taken.

c) Immediately advise the maintenance department of the condition, which will require attention.

d) If it becomes necessary to enter the closed off area before the condition has been corrected, wear an approved respirator before entering.

3. Where it is necessary to gain access to an accessible ceiling space in which asbestos material is or might be present:

a) Such entry shall not be made until the area below the ceiling space is unoccupied.

b) Wear an approved respirator, coveralls, head covering with neck protection to prevent ceiling space dust, if present, from falling on to your normal work garments.

c) Open the access panel, limiting the amount of disturbance to dust or the material to a minimum, while working in the space.

d) If the material is undamaged (or non-existent) normal use of the space may be resumed after the access panel has been replaced.

e) If the material (if present) is damaged or is discovered to be deteriorating, the area below shall be closed off and precautions taken

as described in 2 a) to d).

B. When Working With or Near to Materials Containing Hard Asbestos

1. If the material is in an undamaged condition:

a) No special precautions are required.

b) Thoroughly wash hands immediately after handling the material, appliance, or object containing such material.

2. If the material or appliance has been damaged or broken:

a) Place a warning sign at the location of the damaged area. (See Appendix E.)

b) Advise the maintenance department of the condition for their attention.

c) Remove all broken pieces and place them in a plastic bag and label for safe disposal.

d) Wet mop the area, if required, and thoroughly wash mop and pail.

e) Wash hands after clean-up.

OPERATIONAL PRECAUTIONS - MAINTENANCE AND CONTRACTING PERSONNEL.

A. When Working Near to Materials Suspected of or Containing Friable Asbestos

1. If the material is in an undamaged and well protected condition and if it is not intended

to disturb it in any way:

a) No special precautions are required.

b) Exercise care while working to prevent any disturbance to the material. If it is probable that the material might be disturbed while work is in progress, wear an approved respirator. (See B 3.)

B. When Performing Minor Repairs to Suspected or Confirmed Friable Asbestos Material or to Equipment Covered by such Asbestos Material

1. Before any preparations are started, advise the Principal, and co-ordinate the planning as required.
2. Install an appropriate warning sign in a conspicuous location in, or at the entrance to, the work area. (See Appendix E.)
3. Before commencing any work, wear an approved respirator, securely fitting so that no leaks occur between the respirator and the face of the wearer. Wear coveralls and head covering with neck protection.
4. Shut down all ventilation fans serving the work area.
5. Seal and tape all ventilation openings with 6 mil polyethylene film and strong adhesive tape.

6. Remove all moveable furniture, appliances and equipment from the work area.
7. Cover all remaining furniture, appliances and equipment with minimum 6 mil polyethylene film, excepting the equipment to be worked on, and securely seal all joints with a strong adhesive tape.
8. If required:
   a) Cover all walls, floors and ceilings excepting the area to be worked on with minimum 6 mil polyethylene film with all joints securely taped.

      OR

   b) Secure the work area in an air tight 6 mil polyethylene enclosure made of wood or other suitable framing of sufficient size to allow for proper performance of the work required.

9. Provide a mop, pail and water at the entrance to the work area for clean-up purposes after work. Provide a spray container with water as described below.
10. Before performing any work, gently spray the surface of the asbestos material with water specially treated with a wetting agent to penetrate the material to its full thickness.

This procedure reduces to a minimum or eliminates the dispersal of fibres from the material to the air when the material is disturbed.

A wetting agent that is available is contained in Appendix C - Specification article 6.2.

11. Perform the work required (pipe repair, carpentry, valve servicing, asbestos repair etc.) but limit disturbance of the material as much as is practicable. If work performance is of long duration, respray the material surface as often as required to keep it wet.
12. After completion of work, place all loose asbestos material in plastic bags, and place plastic bags in containers labelled with special instructions for their safe disposal. (Refer to Disposal section for information concerning disposal.) Re-spray the removed material, if it has dried out. to keep it wet during the bagging operation.
13. Remove warning sign only if work is completed and all asbestos material has been removed or safely treated. Otherwise it shall remain until this is done.
14. Sweep and wet mop all exposed surfaces in the enclosed area.

15. After wet mopping, remove all polyethylene film and tape by rolling or folding and place it in plastic bags and containers for safe disposal as previously described.
16. Remove all coveralls before leaving the work area and place them in plastic bags to be recleaned separately from other laundry, or for safe disposal. Thoroughly rinse all respirators and replace the filters (if they are not the disposable type). Place used filters (when wet) in a plastic bag for safe disposal.
17. Thoroughly rinse mop and pail and all equipment used during the wet-mopping procedure.
18. Immediately after all clean-up has been completed thoroughly wash hands, face and all other body surfaces exposed during the performance of work.

C. <u>When Working with Hard Asbestos Materials</u>

1. <u>If the material will not be cut, broken, filed, abrased, molded, or reformed</u> in any way
   a) No special precautions are required.
   b) Thoroughly wash hands immediately after handling the material, equipment or appliance containing such material.
   c) Cutting of this material is not recommended unless it is absolutely necessary.

2. <u>If the material must be cut, broken, filed, abrased, molded or reformed</u>:

a) Seal off the work area and take all precautions as described in B 1 to B 9, inclusive. Wear disposable coveralls, disposable head and neck covering, and disposable foot covering;

OR

If practicable, remove the material to a convenient work area and seal it off, as described in B 2 to B 9. inclusive. Wear disposable coveralls, disposable head and neck covering and disposable foot covering.

b) Provide an approved vacuum unit with approved filter in a suitable location.

c) Provide a properly sized vacuum line, with the outlet end connected to the vacuum unit, and the inlet connected to an intake fitting, located as closely as practicable to the point at which work on the material will be performed.

d) Start the vacuum unit before working on the material, in order to trap the <u>dust</u> which will be generated. If it will be practicable to work on the material in a wetted condition,

the material should be wetted with water as described in B 10. in which case vacuuming is not practical.

e) Perform the work required.

f) After completion of the work, adopt all the precautions as described in B 12 to B 18 inclusive.

D. When Demolition is Planned in an Area in Which Asbestos Material is Located.

This sub-section applies to renovation or demolition of part or all of an existing building.

1. If the material is hard asbestos:

a) Remove and store it separately for separate disposal as described in B 12. Wear an approved respirator and protective covering as in B 3.

b) Thoroughly wash hands immediately after all asbestos material has been removed, and at the end of each work period. Clean-up protective covering as described in B 16.

2. If the material is friable asbestos:

It shall be removed before other demolition work begins. The removal work shall be done in accordance with Appendix C - Specification, titled "Removal of Friable Asbestos Coatings."

OPERATIONAL PRECAUTIONS - BUILDING USERS AND OCCUPANTS

A. When Working Near to Materials Suspected of or Containing Friable Asbestos

1. If the material is suspected to be asbestos and is in good "as installed" condition, and is not damaged in any way:

   a) No special precautions are required.

   b) Advise the teacher or other person in authority of the presence of the material if this had not been done previously. (Previous notification will be indicated by an appropriate sign mounted on, or adjacent to the material. See paragraph e.)

   c) The teacher, or person in authority shall advise the principal of the presence of the material, if this had not been done previously.

   d) Do not touch the material, or disturb it in any way.

   e) The Principal, on the first notification of the presence of the material, shall arrange immediately to have a warning sticker installed on or near to the material, to indicate that it is suspected to contain asbestos. (See Appendix E.)

   This sticker shall remain in place until tests made on samples of the material prove that the suspected material is free of asbestos.

f) If the suspected material becomes damaged during routine activity, the area shall be evacuated immediately and the principal advised of the condition, and of the action taken. The Principal shall then advise the maintenance department of the damage for immediate attention.

g) Building occupants or users shall not use friable asbestos material for any purpose whatsoever in the school environment.

B. When Working with Appliances or Equipment Containing Hard Asbestos

1. Each appliance or item of equipment containing asbestos material shall have a warning sticker installed on it to indicate the presence of asbestos. (See Appendix E.)

2. a) Provide an approved vacuum cleaner with an approved filter and approved respirators in each automotive teaching shop, to be used for vacuum cleaning of brake drums of automobiles before performing braking system service work.

b) Vacuum cleaning shall be done immediately after the wheels have been removed, and approved respirators and coveralls shall be

worn by the persons removing the wheels. Vacuum clean the brake drums, brake shoes, brake linings and all areas where brake dust accumulates.

c) Wipe the areas with a damp rag, and dry with another rag or absorbent paper towel before commencing work. Dispose of the rags and/or towels immediately after use in a plastic bag, labelled for safe disposal. Use the same disposal method as described previously in item B 12 for maintenance and contracting personnel when performing minor repairs to friable asbestos. Wear respirators when changing filters.

Recommendation 43.

That all personnel working with, or near, suspected or confirmed asbestos-containing materials be provided with proper instructions on the procedures to be taken for reducing the formation of dust to a minimum and be fully apprised of the potential exposure problem.

Recommendation 44.

That suitable warning and safety signs be provided in the area where maintenance is occurring on or near suspected or confirmed asbestos-containing materials.

Recommendation 45.

That procedures regarding the use of asbestos materials in teaching programs, e.g. brake linings, clutch discs, be reviewed by the Technical Shop Directors.

12

APPENDICES

APPENDIX A

MINISTRY MEMORANDA

Ontario

Ministry of Education

Central Ontario Region

Telephone
416/491-0330

2025 Sheppard Ave. E.
Suite 3201
Willowdale, Ontario
M2J 1W4

File number

MEMORANDUM TO: DIRECTORS OF EDUCATION
CENTRAL ONTARIO REGION

SUBJECT: ASBESTOS HAZARDS

The Minister of Education has requested that a survey be undertaken by school boards of all schools in the province to determine if any hazardous conditions exist due to asbestos.

Kindly review the facilities within your jurisdiction and report to us the following data:

(a) name of building,

(b) year of construction,

(c) use of exposed asbestos in the form of sprayed surfaces, wall boards, counter tops, etc., and approximate extent of the application,

(d) plans for a remedy to the existing condition.

A reply to Mr. A.C. Cunningham of this office by August 31, 1979, will be appreciated, including a Nil report where applicable.

M. Liebovitz
for

John W. Storey
Regional Director of Education

c.c. Senior Business Official

July 17, 1979

Ontario

Ministry of Education

Central Ontario Region

Telephone
416/491-0330

2025 Sheppard Ave. E.
Suite 3201
Willowdale, Ontario
M2J 1W4

File number

MEMORANDUM TO: DIRECTORS OF EDUCATION
CENTRAL ONTARIO REGION

SUBJECT: ASBESTOS HAZARDS

This is written as an assistance to boards in their answering the memorandum of July 17, 1979, on this subject.

Below are listed the major types of asbestos hazards which should be reported:

1. Asbestos sprayed on exposed metal surfaces, such as steel beams and ventilation hoods in laboratories. To some degree, suspended ceilings would overcome the hazard represented by sprayed asbestos on overhead steel beams.

2. Asbestos panelling and counter tops in cases where the hard protective surface has been broken and the inner asbestos component exposed.

3. Mechanical installations such as air conditioning and heating units which might have loose asbestos particles within it.

J. W. Storey

John W. Storey
Regional Director of Education

c.c. Senior Business Official ✓

July 27, 1979

Ontario

Ministry of Education

Ministry of Colleges and Universities

Mowat Block, Queen's Park
Toronto, Ontario
M7A 1L2

1980:B 1

MEMORANDUM TO: DIRECTORS OF EDUCATION

RE: ASBESTOS HAZARDS

The mid 1979 survey to ascertain asbestos hazardous conditions made reference to the following types of materials:

1. Exposed fibrous materials applied to the ceilings and other surfaces within the building.

2. Fibrous materials applied to the underside of floor slabs, structural framing, columns etc. above suspended ceilings where the space is used as an air plenum.

3. Hard boards used as wall panels, counter tops etc. and floor tiles.

Samples of the materials described under Item 1 and 2 should be carefully collected and sent for analysis for asbestos content to the Occupational Health Laboratory of the Ontario Ministry of Labour. If the tested material contains asbestos fibres an assessment should be carried out to determine what corrective action should be taken by school boards and other educational authorities.

The method of collecting samples should be in accordance with the manual "Inspection of Buildings for Asbestos" produced by the Ministry of Labour. This manual was prepared for the Ministries of Education and Colleges and Universities and a copy is enclosed for your use.

The Architectural Services staff, Grants Policy Branch of the Ministries will assist school boards where necessary, to determine the most satisfactory corrective action in those cases where analysis reveals asbestos fibre content in the material.

D. A. Penny
Executive Director
Planning and Policy Analysis

January 25, 1980

Ontario

FEB 18 1980

Construction & Maintenance

Ministry of the Solicitor General | Office of the Fire Marshal | Public Safety Division | 590 Keele Street Toronto, Ontario M6N 4X2

Telephone: 965-4855

February 12, 1980

MEMO TO: Directors of Education
Presidents of Colleges and Universities

RE: TREATMENT OF ASBESTOS AND FIRE SAFETY REQUIREMENTS

The Ministry of Education, Ministry of Colleges and Universities has provided information about health hazards associated with asbestos in educational buildings. This Office is concerned about the methods used to rectify these problems where asbestos provides fire protection to structural steel, such as columns, beams, joists, or steel decks in floor and roof construction. It may even have been used in some fire-rated walls. In correcting health hazards, the structural fire protection must be maintained.

If removed, the asbestos must be replaced with a material which provides the required fire resistance. This also applies where asbestos has fallen away from structural members, or to areas of asbestos which have been damaged. None of the materials presently proposed as protective coatings for asbestos have been tested as fire protection for steel members, and these materials alone cannot replace asbestos as fire protection. When materials are applied over asbestos, the asbestos must be in good condition, and the bond between the asbestos and the steel must not be broken by application of the protective coatings.

Coating materials must not affect the performance of the asbestos under fire conditions.

Another concern is that the materials used to encapsulate or over spray asbestos will not spread smoke or flame, especially where large ceiling areas, or ventilation spaces are involved. Such materials must meet present Code limitations on flame spread ratings.

It is expected this Office will be advised when projects of this nature are undertaken, and that the local authorities will also be consulted.

K.G. Reilly

K.G. Reilly, P. Eng.,
Consulting Services.

c.c. Superintendents of Business Affairs/
Superintendents of Plant (School Boards)
Directors of Plant (Colleges and Universities)

APPENDIX B

LIST OF ASBESTOS PRODUCTS

PRODUCTS CONTAINING ASBESTOS

The following is only a selected list of products containing asbestos which are present and used in general practice. A study was recently completed on behalf of the U.S. Consumer Product Safety Commission and over 120 data sheets for various products were included. It is estimated there are over 3000 products which contain asbestos (over two thirds in the construction industry).

Automotive brake linings
Automobile hoses
Asphalt paving
Asphalt roof coatings
Auto rustproofing
Boiler lagging
Breeching insulation
Building papers
Clutch facings
Corrugated sheets
Cooling tower components
Chemical tanks
Dentist moulds
Duct vibration connectors
Driveway sealants

Electric motor components

Electrical conduit

Electrical wire insulation

Electrical switchboard components.

Filtrations for soft drinks, beers, wines, oils & chemicals

Foundation waterproofing

Furnace cement

Fire blankets

Fire hoses

Fireproof draperies

Fireproof absorbent papers

Floor tile

Gaskets

Gas vapour ducts for corrosive components

Hard pressed flatboard & perforated ceiling tile

Heat shields for spacecraft

Hot water storage tank insulation

Heat/fire protective clothing

Industrial friction materials

Insulation

Laboratory furniture

Molten glass & metal handling equipment

Plaster

Paint

Pipe insulation

Putty

Pump components

Reinforced plastics

Refractory materials

Reinforced rubber belting

Roof patching compounds

Sprayed structural steel fireproofing

Sprayed roof deck fireproofing

Sprayed acoustical ceilings

Sprayed decorative wall panels

Stage fire curtains

Science room fume hood linings

Siding shingles

Sealants

Small appliance components

Transite pipe

Table pads & heat protective mats

Valve packings

Welding booths

Welding curtains

Welding gloves & aprons

APPENDIX C

SPECIFICATIONS

STD 80	REMOVAL OF FRIABLE ASBESTOS COATINGS	REMARKS TO SPECIFIER
	1. GENERAL	
1.	Conform to General Conditions Form - as amended by the Supplementary General Conditions.	Insert applicable document.
	2. SCOPE OF WORK	
1.	Work Included:	
	a) Removal of spray or trowel applied asbestos coatings or finishes.	
	b) Provision of isolation of work areas.	
	c) Provision of decontamination areas.	
	d) Disposal of asbestos debris.	
	e) Air monitoring.	
	f) Painting surfaces which have been cleared of asbestos.	
2.	Work Not Included:	
	a) Asbestos containment.	This work is specified elsewhere.
	b) Restoration of protective membranes removed under the terms of this contract.	
	3. GENERAL REQUIREMENTS	
1.	All work shall be governed by applicable municipal and provincial by-laws.	OSHA and EPA regulations (U.S.A.) may be cited as guidance documents.
2.	Contractor is required to furnish documentation of successful performance in asbestos removal. Documentation shall include name and address of purchaser of service, location of work performed, and a record of air monitoring for asbestos.	
3.	The contractor shall furnish proof that employees have had instruction on the dangers of asbestos exposure, on respirator use, decontamination, and applicable regulations.	
4.	The Architect reserves the right to order immediate cessation of all work, should he discover that work practices are violating pertinent regulations or are endangering workers.	
5.	Removal of asbestos shall be through application of wet removal techniques. Dry removal of friable asbestos will not be permitted.	Vacuuming skills are being perfected and may be approved in writing upon application.
6.	A warning sign shall be installed in or at the entrance to the hazardous work area.	

REMARKS TO SPECIFIER

4.
DECONTAMINATION

1. Work Clothes

Contractor shall provide and ensure that the following work clothes are worn by workmen on site throughout execution of this contract

a) Full body coveralls of disposable type.

b) Disposable head, boot covers and gloves. — Wear hard hat where applicable.

c) Eye protection.

d) Respiratory protection.

2. Decontamination Areas

Contractor shall provide an adequate decontamination area consisting of a serial arrangement of connected rooms or enclosed spaces.

Contractor shall ensure that all workmen, without exception, pass through this decontamination area for entry into and exit from the work area for any purpose.

3. The decontamination areas shall be set up as follows:

a) Outside room (clean area) - workmen shall leave street clothes here and dress in clean working clothes (disposable overalls). Respiratory protection shall be picked up here.

Workers enter this room either from outside dressed in street clothes or from work area through shower room.

Note: No asbestos contaminated items shall enter this room.

b) Shower room - this room shall be located between clean area and work area. It shall be used for transit by cleanly dressed workmen entering the work area, or by workmen headed for showers from the contaminated area. — Temporary shower stalls shall be provided by the contractor.

c) Equipment room (contaminated area) - this room shall be used for storing work equipment, footwear and work clothing.

d) Work area - this area shall be separated from the equipment by polyethylene barriers. In general, partitions shall be framed with 2 x 4 studs and 6 mill polyethelene plastic sheets applied to both sides of stud partitions. — Temporary toilets should be installed in this area.

REMARKS TO SPECIFIER

4.
DECONTAMINATION
(Cont'd)

Decontamination Sequence

4. Worker must enter outside room and remove clothing, put on clean coveralls and respirator, and pass through into the equipment room (contaminated area). Here any additional clothing required by the worker shall be put on. Work equipment and tools shall be obtained here.

Drinking water and disposable cups shall be supplied here.

5. Worker shall then proceed to work area.

6. Before leaving the work area, the worker shall remove all gross contamination and debris from the overalls.

Workers shall assist each other. Contractor to provide vacuum cleaner with disposable filter bags - for personal use.

7. The worker shall proceed to equipment room and shall remove all clothing except respiratory protection equipment. Extra work clothing may be stored in contaminated end of the unit. Disposable coveralls are placed in a bag for disposal with other material. The worker then proceeds into the shower room. Respiratory protection equipment shall be removed last to prevent inhalation of fibers during removal of contaminated clothing.

8. After showering, the worker shall proceed to the clean room where he will dress in either new coveralls for another entry or street clothes if leaving.

Note: Temporary showers, soap, towels shall be provided by the Contractor.

9. Respirators shall be picked up, cleaned and wrapped by protected workers in a separate area by washing. The respirators must be brought to the clean room by an outside worker.

5.
WORK
PREPARATION

1. The following items or furnishings within the work areas shall be removed prior to commencement of work:

Specify: Responsibility for this work.

a) Loose furniture.
b) Drapes and carpets.
c) Lay-in ceiling tiles, including T-bar grid.
d) Light fixtures.

2. All items removed and scheduled to be re-installed shall be stored and kept safe until required.

3. Equipment or furnishings which cannot be removed shall be sealed with 6 mil polyethylene sheeting.

4. All openings within the work area shall be sealed with 6 mil polyethylene plastic, held in place with suitable tape. Similarly seal joints between sheets. Such openings shall in general encompass ducts, vents, grilles, floor drains, skylights, windows, doors, electrical ducts and boxes.

STD 80	REMOVAL OF FRIABLE ASBESTOS COATINGS	REMARKS TO SPECIFIER

5.
WORK
PREPARATION
(Cont'd)

5. Wall and floor surfaces shall be protected with continuous sheets of similar plastic. Joints between wall and floor sheets shall be tape sealed.

6. The ventilation and forced air heating system of the work areas shall be isolated and turned off.

6.
ASBESTOS
REMOVAL

1. The Architect's approval of all proposed isolation barriers and removal procedures is required. No stripping of asbestos will be permitted until the Architect has inspected the work site and the approval to proceed with the work has been given in writing.

2. No asbestos shall be removed until the fibres have been sprayed with water solution containing an additive to enhance penetration. This additive (or wetting agent) shall be a mixture of 50% polyethylene ester and 50% polyoxythylene ether at a concentration of 1 ounce per 5 gallons of water.

3. A fine spray of this solution shall be applied to prevent fiber disturbance preceding the removal of the asbestos material. The asbestos membrane shall be completely saturated to prevent emission of airborne fibers.

4. Asbestos shall only be removed by hand scraping. Power operated blowers **will not be permitted.**

5. Removed asbestos fibres shall immediately be collected in 6 mil plastic bags and placed in rigid containers having **sealable** lids. Note: Fallen debris must be collected at end of days or shift work. Containers shall be kept **sealed** at all times. — Suggest 55 gallon drums.

6. Fallen asbestos debris shall again be sprayed with amended water before collecting and placing in bags.

7. Packed containers shall be sealed and labelled before leaving the contaminated area. — Apply hazard sticker.

8. Following removal, the entire area shall be wet cleaned. After a 24 hour period to allow for dust settling, the entire area shall be wet cleaned again. During this settling period, no entry, activity, or ventilation will be allowed.

9. 24 hours after the second cleaning, all surfaces in the entire work area shall be vacuumed and wet mopped.

10. All polyethylene material, tape, cleaning material, and clothing shall be placed in plastic-lined drums, sealed and labelled as described above for the asbestos waste material.

REMARKS TO SPECIFIER

6. ASBESTOS REMOVAL (Cont'd)

11. All equipment shall be cleaned of asbestos material prior to leaving the work area.

7. AIR MONITORING

1. Throughout the removal and cleaning operations, air sample monitoring shall be conducted to ensure that the Contractor is complying with all codes, regulations and ordinances. The air monitoring technician and his equipment shall be subject to approval of the Architect.

2. Air monitoring shall be performed to provide the following samples during the period of asbestos removal:

a)

Area to be sampled	Number of samples	Minimum sample volume in litres
Work area	4	60
Outside work area barriers	2	120

Samples will be taken after the actual removal operation has begun.

b) After the second (final) cleaning operation, the following tests shall be performed:

i. A complete visual inspection.

ii. Two air samples within 48 hours after completion of all cleaning work.

Minimum volume of air sample shall be 240 litres.

4. The cleaning operations shall be repeated if:

a) A visual inspection detects asbestos remnant still clinging to the sub strate, and

b) Air sample tests prove fibre count above acceptable limits.

Specify accepted fibre count per cm3 air.

REMARKS TO SPECIFIER

8.
ASBESTOS
DISPOSAL

1. All asbestos materials and miscellaneous debris in sealed drums shall be transported to the predesignated disposal site in accordance with the guidelines of governmental agencies having jurisdiction.

2. The bags may be dumped from the drums into the burial site. The drums may be reused. However, if a bag is broken or damaged, the entire drum should be buried.

9.
ENCAPSULATION
OF RESIDUE
FIBRES

All surfaces cleared of asbestos shall be painted with two coats of Latex paint.

This work is optional. Purpose: to encapsulate any fibre which has not been removed.

10.
COMPLETION

1. Upon instructions by the Architect, Contractor shall remove all temporary partitions, screens, facilities and equipment.

2. Previously removed furniture, owner's equipment, ceilings or light fixtures will be re-installed by owner's forces.

Specify if part of asbestos removal contract.

APPENDIX D

ASBESTOS FREE SUBSTITUTES

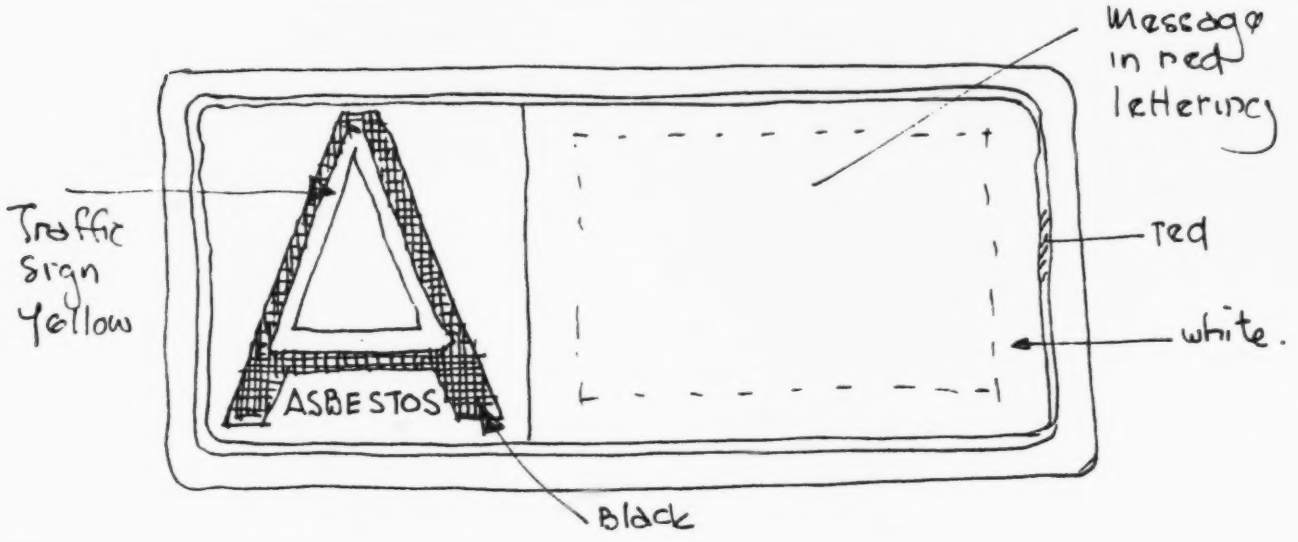
ASBESTOS CONTAINING MATERIAL	ASBESTOS FREE SUBSTITUTIONS
1. Spray applied (friable) asbestos:	
a) Fireproofing	Dry wall and plaster; cementitious spray fireproofing (vermiculite and gypsum or cement); fibrous spray applied (mineral wool and cement).
b) Acoustics	Sprayed cellulose fibres; sprayed mineral wool and binders; fibreglass panels; tectum panels; lay-in ceiling tile. Sound blocks. Acoustical plaster.
c) Insulation	Fibreglass batts, boards. Tectum; sprayed cellulose; foamed plastics; sprayed mineral wool and binders.
2. Hard asbestos:	
a) Transite ceiling tiles	Mineral ceiling tiles; exterior grade drywall (soffits).
b) Transite wall cladding and siding	Metal and pre-finished masonite or plywood.
c) Curtain wall components	Metal or precast concrete.
d) Pipes and ducts	Concrete; P.V.C.
e) Flower pots and boxes	Wood; concrete (precast)
f) Corrugated roof panels	Prefinished metal
g) Pipe coverings and insulation	Fibreg'ass
h) Back-up for exposed aggregate panels	Plywood

ASBESTOS CONTAINING MATERIAL	ASBESTOS FREE SUBSTITUTIONS
3. Asbestos fabrics:	
a) Fire curtain	Metal fabric (being tested)
b) Fire blankets	Fireproofed wool cloth
c) Fire stop flaps	CK-2000 thermal blanket of ceramic composition
d) Welding booth curtain	No tested product
e) Gaskets, ropes (joint filler)	Metal, mineral fibre felts
f) Safety clothing	Leather, aluminized cloth, insulated leather gloves, fireproofed flannel.
4. Electric wiring insulation	P.V.C. tubing, jackets

APPENDIX E

WARNING SIGNS

PROPOSED STANDARD
WARNING SIGN



MESSAGE # 1

2

3

4

A

DAMAGED ASBESTOS MATERIAL

Do Not Attempt To Repair.

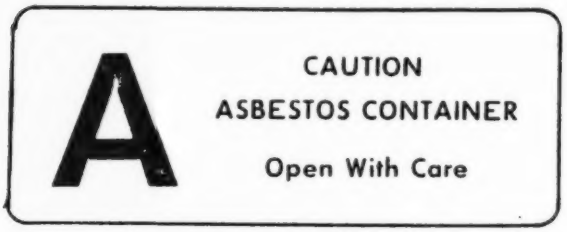
A

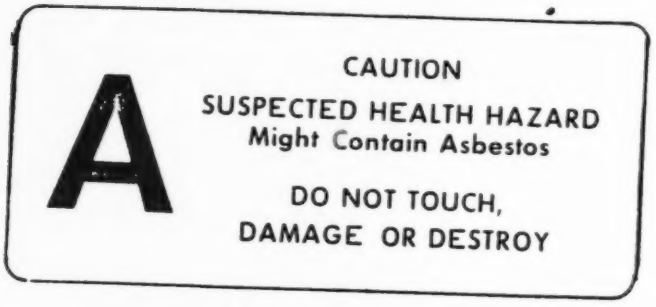
DANGER, ASBESTOS

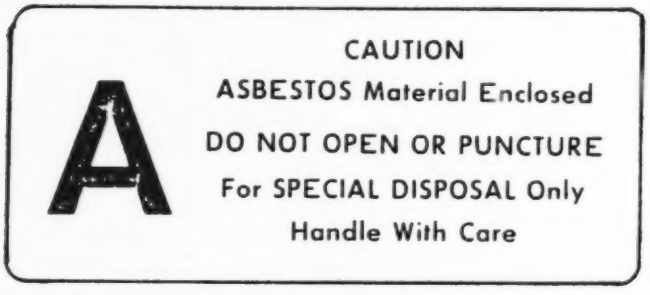
Hazardous Material Present

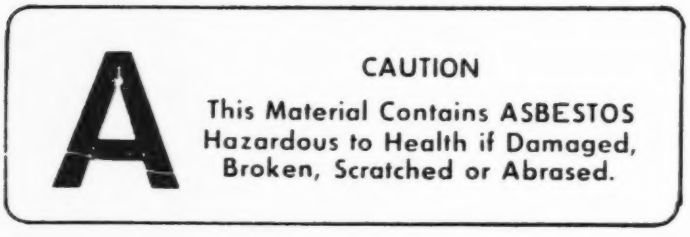
DO NOT ENTER

Authorised Persons Only


A
CAUTION
ASBESTOS CONTAINER
Open With Care


A
CAUTION
SUSPECTED HEALTH HAZARD
Might Contain Asbestos
DO NOT TOUCH,
DAMAGE OR DESTROY


A
CAUTION
ASBESTOS Material Enclosed
DO NOT OPEN OR PUNCTURE
For SPECIAL DISPOSAL Only
Handle With Care


A
CAUTION
This Material Contains ASBESTOS
Hazardous to Health if Damaged,
Broken, Scratched or Abrased.

13

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BIBLIOGRAPHY

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